621.30 E38

ELECTRICAL AGE

INDEX TO VOLUME XV.

JANUARY 5 TO AND INCLUDING JUNE 29, 1895.

ELECTRICAL AGE PUBLISHING CO., - World Building, NEW YORK CITY.

**Illustrated Articles.*

41412

ELECTRICAL AGE

VOL. XV., No. 1. NEW YORK, JANUARY 5. 1895. WHOLE No. 399

ESTABLISHED 1883.

Entered at New York P. O. as second-class matter, January 18, 1891.

THE ELECTRICAL AGE PUBLISHING CO., PUBLISHER

TERMS OF SUBSCRIPTION:

One Copy, one year,	$3.00
One Copy, six months,	1.50
Great Britain and other Countries,	4.00

Cable Address (all Cables,) "Electage," New York.

W. T. HUNT, President F. N. BASSETT, Vice-President.

T. R. TALTAVALL, Secretary and Editor.

NEWTON HARRISON, E. E., Scientific Editor.

ADDRESS ALL COMMUNICATIONS TO

THE ELECTRICAL AGE PUBLISHING COMPANY,

FIRST FLOOR, WORLD BUILDING.

NEW YORK.

NEW YORK, JANUARY 5, 1895.

CONTENTS.

DECLINE IN RAILROAD BUILDING.

During the year 1894 less than 2,000 miles of steam railroad were built in the United States. This is a very marked falling off from the preceding years, the figures for last year being 2,635 and 4,187 in 1892. In 1889 7,421 miles were built, but since then the decline has been rapid and steady. Industrial conditions undoubtedly are, in the main, responsible for this state of affairs, but it would be interesting to know what proportion of the decline is due to the introduction of electric railways.

LAST WEEK'S STORM.

The snow and wind storm of last week caused interruption to street car travel in the many places lying within the limits of the "blizzard," which were very wide. Snow plows were in great demand, and even with their aid it was difficult in many cases to keep the lines open on account of the drifting snow. In various places trolley, electric light and other wires were blown down, causing great inconvenience. No cases of special injury to persons were reported, however. The storm was general in the Middle and Eastern States and considerable damage was done in the manner indicated above. The storm was followed by a cold wave, which sent the mercury down towards the zero point, and the cold added much to the difficulties of the situation.

A MODEL MUNICIPAL PLANT.

Advocates of the municipal control principle as applied to electric street-lighting, and the opponents, too, for that matter, will find interesting reading in the report of the Board of Electric Light Commissioners of South Norwalk, Conn. We print on another page in this issue a full abstract of this report. South Norwalk is fortunate in having an intelligent board in control of its electric light affairs. A municipal enterprise of this character can be made a very costly one to the taxpayers if it is not managed on business and common-sense principles, but if honest men are placed in charge there is no reason why the taxpayers should not be the gainers. The citizens of our Connecticut neighbor are certainly getting their electric light very cheap.

THE BROOKLYN TROLLEY EMPLOYÉS.

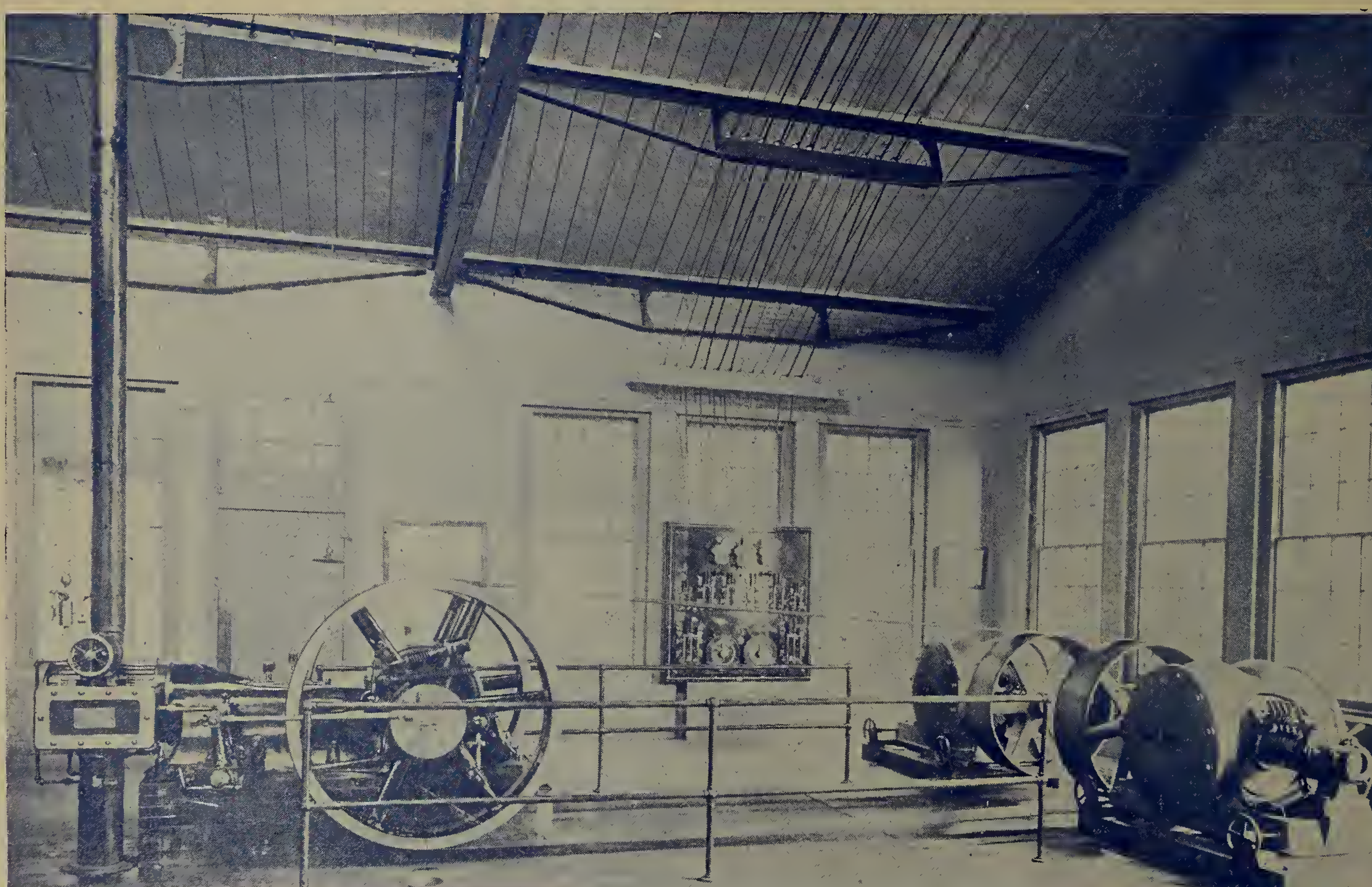
A state of tension exists in the relations between the Brooklyn street railroads and their employés over the efforts on the part of the latter to secure an increase of wages. For several days conferences have been held between President D. F. Lewis, of the Brooklyn Heights Railway Company, and a committee representing the employés. Every difference, excepting that concerning the pay of motormen and conductors, has been practically adjusted. The men are firm in their demand for an increase of 25 cents a day in their wages from $2, the present rate, but the companies are determined not to grant the increase. They assert that to do so will seriously impair their profits. At last reports, however, there was a hope that a compromise figure would be settled upon, and that the threatened strike would be avoided. The companies, of course, are operating under an enormous expense, but their receipts are also enormous, and they should be liberal towards these two classes of employés. When the responsibility that rests upon the motormen, and the intelligence and good judgment the position demands, are considered, two dollars a day and even three dollars is ridiculously small pay. The motormen as a rule are an intelligent lot of fellows, and they must have their eyes wide open and their wits about them every moment while on duty. The presidents of the railroads should once try for themselves to see what it means to run an electric car through crowded city streets. We dare say that such an experience would help them realize the responsibility that rests upon the shoulders of the motormen, who work for ten or twelve hours, exposed to all kinds of weather, and under great strain for a paltry two dollars a day. This class of employés certainly deserve a fair remuneration for their services. Motormen are, as a rule, faithful to their trust and we often wonder how the companies get intelligence so cheaply.

ELECTRIC PLANT AT THE GOULD COUPLER WORKS INSTALLED BY HENRY B. OAKMAN.

The electric light plant at the works of the Gould Coupler Company, in Depew, N. Y., is one of the most complete in that section of the country.

The works are illuminated by 80 arc ("Ward") lamps and 200 incandescents. The current is supplied by two 50-K. W. Wenstrom dynamos, which are compound wound and run at a speed of 400 revolutions per minute. The dynamos receive their power from a Ball engine, with which they are connected by Munson belts.

The floor of the engine room is constructed of concrete, giving the strongest possible foundation with the least vibration. The switchboard is made of slate and is 10x10 feet in size. It is equipped with Weston illuminated-dial voltmeters and ammeters and six circuit switches, four of 150 amperes capacity and two of 100 amperes. The company's plant embraces six buildings, the circuits in which are controlled from this one board. Each circuit contains arc and incandescent lamps and the wiring is of a special character. All the wires in the dynamo room, it will be seen, are placed on insulators away from the building structure and accessible at all times.



ELECTRIC PLANT AT THE GOULD COUPLER WORKS, DEPEW, N. Y.

This plant was installed last spring by Henry B. Oakman, the well-known electrical engineer and contractor of 136 Liberty street, New York City, after strong competition with about thirty-five other bidders for the work. The Gould Coupler Company is the largest concern of the kind in the country and Mr. Oakman justly feels proud of this installation.

Our illustration gives an excellent view of the dynamo room of this plant and shows the two Wenstrom dynamos in a first-class light.

The Barriett & Adams Electric Mfg. Co. recently started business at 370 Gerard avenue, New York City. The company manufactures electric motors and dynamos for all purposes from Mr. Barriett's well-known designs. The firm consists of S. L. Barriett and Frank E. Adams.

ELECTRICAL STEEP GRADE TRACTION IN EUROPE.

BY C. S. DU RICHE PRELLER.

INTRODUCTION.

The rapid growth of electrical traction in Europe, wherever local conditions and reasonable official regulations are conducive to its adoption, is evidenced by the fact that within the last few years it has also been extensively applied, and is in course of further application, on steep-grade or mountain railways properly speaking—that is, on lines which have not only occasional steep-grade sections, such as occur, for instance, on many electrical tramways, but continuous gradients varying from 5 to 25 and upwards of 60 per cent.. (1 in 20, 1 in 4 and 1 in 1.6 respectively), and which connect either the base and summit of a given declivity, or different districts separated by a mountain range. It will, therefore, not be inopportune if I place before the Institution a short synopsis of what has been already done in Europe in that branch of electrical engineering, together with certain conclusions and proposals founded on my own experience. Leaving aside for the present, as being more suitable for separate treatment, the question of heavy—viz., 50 to 100 ton—electrical locomotives for trunk railways, the working of steep grades by electricity may be considered under two heads: (1) by cable traction, and (2) by motor cars or locomotives with fixed conductors.

CABLE TRACTION.

Up to a recent period steep-grade cable railways in various parts of the globe, but notably in Switzerland and in the Alps generally, where they alone exceed 20 in number, have been constructed for being worked either by component of gravity with water ballast in conjunction, on some lines, with a second or compensation cable, or

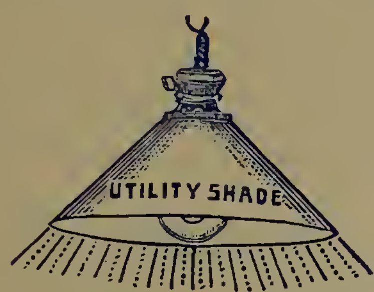
(*Continued on Page 10.*)

* Paper read before the November meeting of the Institution of Electrical Engineers, London.

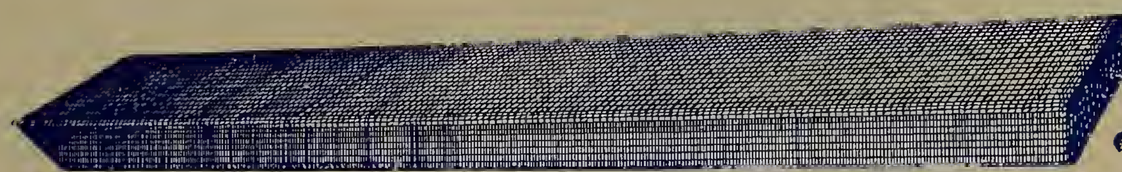
RECORD OF 1894.

(Continued from page 359, Vol. XIV.)

The "Utility Shade" is the name given a very useful incandescent lamp shade brought out last spring by Messrs. Holmes & Walker, and now handled by Follette & Co., 39 Cortlandt St., New York. This shade is made in paper or celluloid and in any color desired. It is flexible and very light, and possesses great reflective power. It is, besides, durable and cheap, and can be washed when it becomes soiled. The Utility shade will fit any socket.



UTILITY SHADE.


BELKNAP MOTOR CO'S WOVEN WIRE AND GRAPHITE BRUSH.

The Diehl Electrolier-Fan combination was received with a great deal of favor last season. A glance at the illustration shows it to be an electric fan operating on the electrolier fixture. The device is attachable to the ceiling and the motor which operates the fan is contained in the basket at the base of the column. The lamps are grouped in a tasteful manner below the basket, and can be burned independent of the motor. The motor itself is an efficient one. All last season these combinations gave great satisfaction. They found extensive use in hotels, private houses, halls, etc., and as they are artistic in design and handsomely finished, Diehl & Co., of 385 Broadway, New York City, the makers, found a large market for them.


DIEHL'S ELECTROLIER FAN COMBINATION.

The Woven Wire and Graphite Brush brought out by the Belknap Motor Co., Portland, Me., last spring became instantly popular. It is made of pure copper wire-cloth, the inside folds being treated with a compound of graphite. The combination of graphite and copper furnishes the lubrication for the commutation and the greatest conductivity to the current. This brush has great flexibility and at the same time holds its shape permanently. These brushes have met with a very flattering reception in the trade and are in very extensive use.

The Hammond Cleat, made by the Hammond Cleat and Insulator Company, 15 Custom House street, Boston, possesses some features that entitle it to consideration. The two-wire cleat, shown in the illustration, is made in one piece of the finest grade glazed porcelain, and furnishes the quickest and easiest way of wiring. It bends the wires slightly and holds them firmly in one position, without injury to the insulation. The cleat is held in place by short screws. Nails with washers may, however, be used in place of the screws.

The portable alternating or direct current voltmeter of the Weston Electrical Instrument Co., 120 William street, Newark, N. J., is regarded by all as the most satisfactory instrument of its class. The portable forms are made in two styles—single scale and double scale. The single-scale instrument has two contact plugs and the double scale instrument three. These instruments are in every respect as reliable and accurate as the station instruments made by this company, which have such a high reputation. Very accurate readings can be obtained, the actual error being about six-hundredths of one per cent. for 1° F. for single-scale, 120-volt instruments, and still lower for higher range instruments.

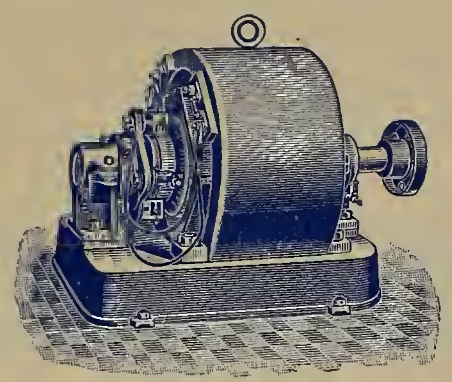
HAMMOND TWO-WIRE CLEAT.

The Interior Conduit and Insulation Company, of New York City, made a valuable improvement in its conduit system during the past year. It now makes an insulated armored conduit, which consists of the Company's well-known plain insulating tube placed within a heavy wall of lap-seamed, wrought iron pipe. This furnishes an armor one-eighth of an inch in thickness. The inner and outer tubes are remarkably well consolidated and welded together. The flexibility of the conduit system is maintained by the use of iron armored insulating junction boxes, elbows, couplings, etc. The iron armored conduit possesses all the qualities of gas or water pipe, and can be installed with the same ease. It can be used under concrete, tiled or mosaic floors. The accompanying illustration shows a continuous insulating nipple, and its application to a junction box.


WESTON PORTABLE VOLTMETER.

Mr. Osborn P. Loomis, of Bound Brook, N. J., last September brought out a slow-speed, multi-polar generator

of a new design. The magnet frames are of iron, cast in one piece, without joint. The machines regulate automatically from zero to full load, and run without sparking. They are designed for light and power purposes, and vary in capacity up as high as 5,000 lights, and they can be



LOOMIS MULTIPOLAR GENERATOR.

constructed of any voltage. These machines are rapidly growing in favor and are giving the best of satisfaction to those operating them. Mr. Loomis also makes motors of the same general design.

REPORT ON MUNICIPAL LIGHTING.

The second annual report of the Board of Electric Light Commissioners of South Norwalk, Conn., for the year ending October 12, 1894, contains some facts of interest on the subject of municipal control of electric light plants.

"Whatever may be the arguments for or against the municipal ownership of electric plants," the report says, "the fact has been amply proven that South Norwalk can supply its own street lights much more economically than by renting them from a private corporation. The reasons for this are plain, because in this instance, the city not alone has the advantage of obtaining its lights at cost, but also owns a valuable asset in its plant, which, by the saving it affords and the depreciation charged against it, will in time cover the original investment. In the instance of a private plant, a stated rate must be paid each year, which not alone must contain the cost of operation, but obviously a fair profit for the owners, in addition to the items of depreciation and interest on the investment, and at the end of the year, the city has nothing to show for the money spent. With the city plant it is different, inasmuch as the money has been used to operate and pay for a public institution that could be disposed of above its original cost, in which it may not be amiss to say, every citizen is an interested share-holder.

"Experience has fully sustained the belief that the city's lighting service can best be operated on simple practical principles, and also that the highest degree of economy can only be reached by the purchase of first-class material and supplies.

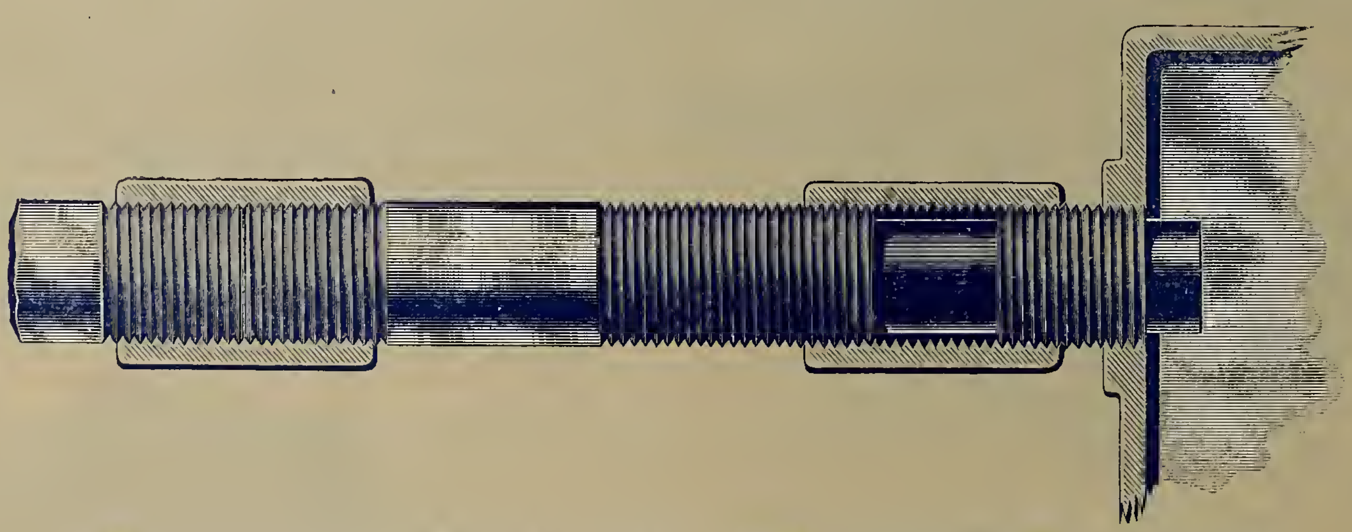
"During the past year the pros and cons relating to the subject of municipal electric plants have been discussed at considerable length in the electrical journals, and it may please those interested to know that out of the total number of municipal plants in the United States (about 150), forty-nine were selected to report on, South Norwalk's plant being included in that number, and in a later article was singled out and much praised as an example plant.

"In comparing the figures of the last report with statistics of a large number of electric light plants, no better showing than that given by South Norwalk could be found, and with the improvement shown in this report over the last, the comparison is still more gratifying. The yearly cost per lamp in last report was $64.53 1-4, against $52.29 3-10, as shown in this. Roughly speaking, there is an average of one street light to each sixty inhabitants of this city, and at the same ratio the cost to each person for the year's lighting is about 97 cents.

"After two years of steady service, the indications of wear and tear to the apparatus has been found to be very light, but in justice to the plant and as a safeguard the rate of five per cent. has been charged against such parts of the plant as are liable to depreciate. If the rate of depreciation was fixed by the cost of repairs it would be hardly worth considering.

"As to accidents, the plant has been very fortunate; no serious accidents have been experienced, and the few minor ones have been quickly repaired at small cost. Lightning, the common enemy of electric plants, in this instance has ceased to be looked upon with dread, owing to the efficiency of the simple lightning arresters by which the system is protected; very few lamps have been affected and none seriously.

"About eight per cent. of the total capacity of the plant is in use at the present time, allowing for a future increase of 20 per cent. before the point of highest efficiency is reached, practically the limit of capacity. No consistent effort has been spared in the endeavor to improve the system and facilitate its operation. In this connection, it may be well to mention a new and important means of reducing the cost of fuel, which after a satisfactory trial has been adopted. The item of fuel is one of the heaviest expenses of a steam electric generating plant, and every possible method is employed to get the greatest amount of work from the smallest outlay in coal. The means with this end in view, which has been adopted, consists in mixing locomotive sparks with first-class bituminous coal. in quantities of one part sparks to two parts coal, which produces a fine composite fuel that burns readily in the furnace. These sparks, which heretofore were supposed to have no other function than to get in the eyes of unfortunate passengers, are particles of coke which are collected in the smoke arch of locomotives. They are bought from the N. Y., N. H. & H. R. R. in the car loads at very low rates in comparison to coal, and by their use the cost of coal is greatly reduced.



INTERIOR CONDUIT AND INSULATION CO'S IRON ARMORED CONTINUOUS INSULATING NIPPLE.

"The performance of the various apparatus composing the plant has been very satisfactory. The "Weitmeyer" furnace has proved a paying investment in saving coal. The "Ideal" engine runs as steady as the day it was accepted. As to its high efficiency there can be no question, while its oil-saving qualities are remarkable, only three-quarters of a pint during a night's run being consumed on the bearings, which have never yet run hot. No one

can enjoy the soft, brilliant illumination of our streets without words of well merited praise for the Western Electric system which produces it, and those who have the apparatus in charge fully appreciate the reliability and simplicity of its operation.

"This satisfactory operation of the entire plant is largely due to the faithfulness of the operating force in the performance of their duty. To their willing, united efforts is primarily due the economic operation of the plant, for the best apparatus cannot be efficient without constant, watchful care."

Leslie Smith, Joseph A. Volk and Albert E. Winchester constitute the Board of Electric Light Commissioners.

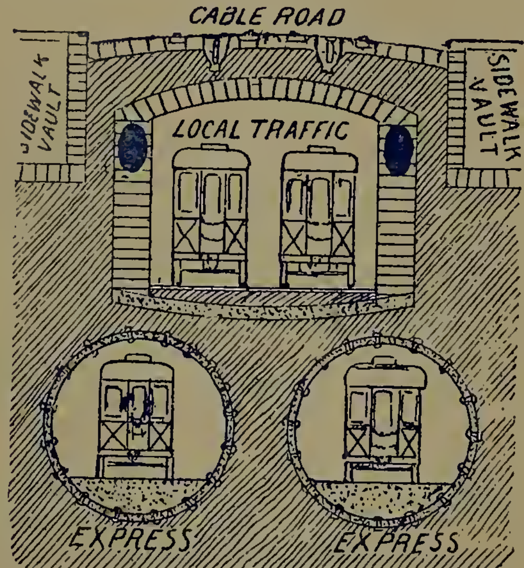
THE RAPID TRANSIT PROBLEM IN NEW YORK.

At the meeting of the Rapid Transit Commission, held on December 26, Chief Engineer W. B. Parsons made a report, giving estimates for the construction of the proposed underground railway system.

The report dwells on the engineering difficulties to be met with in laying out and constructing the underground route as proposed, and suggests a way of overcoming many of them.

The provisional plans provided for a space of forty-four feet in width, for four tracks, and this would cut into the Broadway sidewalk vaults about two and a half feet on each side of the street. It was also proposed to use specially constructed low cars.

Mr. Parsons gives these objections to the adoption of the provisional plans:



PARSON'S PLAN FOR RAPID TRANSIT UNDERGROUND ROAD.

First—The cross-section is entirely too small for the safe and efficient working of a rapid transit railroad.

Second—The provisionally adopted plans give no consideration to the question of sewers.

Third—The construction of a four-track road, as shown on the plans, without disturbing the surface of the street, involves tunnelling methods that are without precedent. The success of such methods are entirely problematical, and the great risks to all the interests involved do not justify their consideration.

The report then continues:

"The construction of a four-track road in Broadway by any plan will be open to many objections. Broadway is at present the only thoroughfare in the lower part of the city; it is lined with expensive buildings, and its traffic at all times is very heavy. These conditions will inflict an increased cost on the construction of a railway, and the crowding of the work of building the latter in an already congested street must interfere with its regular business. A result equally advantageous to the city at large can be accomplished, in my opinion, by building a four-track railway from Union Square through New Elm street to the City Hall, and thence a two-track line through Nassau and Broad streets to the South Ferry. This can be supplemented at any time, if desired, by a two-track road from Union Square through University place, Greene and Church streets to the City Hall. Since the express trains would make no stops between Fourteenth street and City Hall, the two-track road on Church street would give the same accommodation between those points to the territory west of Broadway that the four tracks do to that east of Broadway.

"If, however, you do not accept these suggestions and decide to adhere to the Broadway route with four tracks, I submit for your consideration the following plans, which have been designed to lessen the objections stated.

"The principle of the design is the treatment of the local tracks and the express tracks as separate railroads, and the construction of each double track independent of the other, so as to obtain the maximum of efficiency for both.

"The former would naturally follow the undulations of the street as closely as possible in order to have a minimum depth at the station platforms, while the express line should have shallow stations at long distances, and between these stations be run on more favorable gradients. The express stations will be located probably at City Hall and Fourteenth street. At City Hall the platforms can be kept near the surface, and at Fourteenth street all tracks can be brought to the same level, or a double-deck station can be constructed, as may be preferred. The double-deck station presents the advantage of a separation of the tracks at the Fourteenth street junction, and also of a possible continuation of the method of the proposed construction as far as Thirty-fourth street, so as to pass the narrow portions of Broadway at Eighteenth street and Twenty-eighth street without the difficulty attending the construction of four tracks on a level. By this method there will be less interference with the vaults or private property, and, as the excavation will be at a greater distance from the house lines, there will be less necessity for underpinning.

"By the plans submitted the railway would be constructed by taking one-half of the street at a time, laying the side walls in a trench and then turning half the arch. The other half of the tunnel would be completed later. All the material beneath this arch could be excavated after the latter was completed and the street surface restored. The lower tunnel could be constructed by means of circular shields, and as these would be driven beneath the masonry tunnel previously constructed, there would be little danger of a movement of the ground sufficient to affect the street surface. The running of the cable railway would not be interrupted.

"The material used in the construction would be of the most durable nature, as the upper tunnel would be constructed entirely of masonry, and would not be corroded, as iron would be, by the gases and acids and other substances with which the soil next to the surface is saturated.

"This plan also presents the advantage of the city being able, in conjunction with this work or subsequently, to build pipe galleries on the haunches of the arch.

"The making of an estimate in advance of detailed plans is always a difficult matter, but especially so in this case, on account of the complicated character of the work. Where buildings will have to be underpinned, and property rights invaded, it is almost impossible to make reliable figures. How far property rights go with the vaults, and whether the owners can or will make any claim for compensation for their loss, or to what extent claims for other damages will be made, must be left for others to decide. To the item for the construction of the provisionally adopted plans there must be added these additional amounts.

"Having advised you that it is not reasonably practicable to build a four-track railway without disturbing the surface of the street, I make no estimate of the work done in that manner.

"In the estimates herewith presented I have added a large amount for contingencies, which is intended to cover such as may arise during construction, but nothing has

been allowed for property rights or damage to abutting property."

Mr. Parsons then gives estimates as to the cost of the roads built according to the provisional plans, and the one suggested by himself. The cost under either plan, he says, will be from $65,000,000 to $66,000,000, not including allowance for private property, property rights, or damages to abutting property.

It was resolved by the commission to submit the report to a body of experts, five in number, they to report as early as possible on the plans submitted, estimates of cost, etc., and further, whether they, the experts, can suggest any better solution of the problem.

THE LAW OF INVENTION.

BY HORACE PETTIT.

(*Concluded from page 360, Vol. XIV.*)

EDISON LAMP.

Another illustration which may be used in this connection is the Edison incandescent electric lamp (U. S. Patent No. 223,898, January 27, 1880) This has gone most largely into commercial use, and there are now few small towns in the United States, as well as in Europe, which have not installed some of these incandescent electric lamps.

Mr. Edison had his patent sustained in two or three of the Circuit Courts of the United States (Edison Electric Light Company *vs.* U. S. Electric Lighting Company, 47 Fed. Rep., 454, Dist. N. Y., affirmed, 52 Fed. Rep., 300; Id. *vs.* Beacon Vacuum Pump and Electrical Company, 55 Fed. Rep., 678, Dist. Mass.) In one or two of the later cases a new defence, in the shape of an alleged anticipation of the Edison patent has been presented, and very elaborately, in the case of the Edison Electric Light Company *vs.* The Columbia Incandescent Lamp Company (65 Off. Gaz., 133 East Dist. of Missouri) on motion for preliminary injunction. In this case the court refused the preliminary injunction. Without having had the pleasure of examining the evidence presented upon the motion for preliminary injunction, I understand, from the data given in the report, and from other unofficial data, that the defence alleged is, substantially, that one Henry Goebel, a German by birth, came to this country prior to 1854, having acquired some knowledge of electricity abroad. He opened a small shop in the lower part of New York City and plied a desultory kind of a trade in repairing watches, telescopes and optical instruments; that before coming to this country he had become in some manner associated with a gentleman familiar with electricity, who suggested to him the idea of producing light by means of electricity through the medium of a film to be rendered incandescent in a vacuum bulb; and that after opening his shop in New York he spent some of his leisure time in carrying out this idea, and did make, as early as 1854, out of fine strips of bamboo, films which he encased in a glass globe rendered air-tight, and by connecting a current from a battery, or other source, produced what was substantially an incandescent light, his lamp being different in form, but in all essential features the same as those now in general use.

Goebel exhibited this in his shop window as a matter of curiosity, and also on the streets of New York, at the base of a large telescope, which he took around in the evenings to allow passers-by, at a small price, to view the stars; the incandescent lamp here also operated as a curiosity, or means of attracting attention to his telescope. It appears that Goebel has recently made several lamps of the form and with the material and tools formerly used by him. "These lamps," said Judge Hallett, in the Missouri case, "were tested by men of skill and experience in such matters, and they were found to be reasonably effective. They are not so good as the lamps in common use; but they can be operated and they give reasonable service in time and capacity of light."

The Judge did not appear to think Goebel's testimony to be at all improbable, and that it was supported at many points by witnesses of good repute, who spoke with precision and apparently with deliberation.

This case is peculiar. The invention might have been for practical purposes completed by Goebel in 1854—we may say perfected—and yet not have gone into general use or have been taken up by the public because it required something outside of itself to bring it into general use—a commercially practicable current generator, which was not perfected until a much later date. If defendant's contention is correct, Goebel's lamp of 1854, applied to the present dynamo, would have successfully operated, and containing, as contended, all the essential features of the claim of the Edison, 1880, patent, would defeat the claim.

If in this case defendant's contention is correct that the Goebel lamp did contain all the essential elements of the Edison lamp, there being no substantial difference between the two, the fact of Edison's commercial success, and of supplying the public want, would not enter into the consideration of the case, as this was due, not to perfection or change in invention, but to an *extraneous fact*, namely, the coming into existence of the commercial dynamo. On the other hand, it might be urged, why did Goebel not bring forth his invention immediately upon the introduction of the commercial dynamo, and not wait until thirteen years after Edison secured his patent before the Goebel claims should be pressed. Numerous explanations might be made to this contention. If the testimony to be produced upon final hearing substantiates that which appears to have been produced by affidavits upon the motion for preliminary injunction, it would certainly look as though Mr. Edison would be deprived of the credit of being the inventor of the incandescent lamp. All engaged in patent practice, however, know that it is easier to defeat a motion for preliminary injunction and cast the time-worn "reasonable doubt" upon validity, than to ultimately sustain it upon final hearing.

Section 4886 says "any person" is entitled to a patent who has invented or discovered, etc. This leaves no doubt that any one who answers the other requirements is entitled to a patent, be the inventor native or foreign born, black or white, adult or minor, male or female. It was formerly not so in the United States. Aliens were discriminated against; but through sundry acts of Congress the *alien* was placed upon a par with the native born. Should an inventor die before obtaining protection by letters-patent, his invention may be patented by his executors or administrators, with full protection of his rights.

The wording of this section of the act is very plain, but the adaptation of it to the particular cases as they arise is most difficult. The section of the act says: "Any person who has invented, or discovered, any new and useful art, machine, manufacture or composition of matter," etc., is entitled to a patent. The section of the act does not say what invention is; that question is left to the Patent Office in the *first* instance, and to the courts *ultimately*. As there appears to be no fixed rule by which invention is to be determined, it is one of the most difficult questions which a patent attorney has to solve, to successfully decide, especially in *border line* cases, what is, and what is not, invention; the court has the last guess.

Mr. Walker, in his work on patents, section 24, says: "It is seen to remain true that the ideal line which separates things invented from things otherwise produced has never been completely defined or described. There is no affirmative rule by which to determine the presence or absence of invention in every case" (citing Dunbar *vs.* Field Tack Co., 4 Ban. and Ard., 519).

Robinson on Patents, Vol. I, section 59, says it is perhaps incapable of exact definition, and the line between it and what the patent law regards as a mere imitation is not very difficult to draw.

Mr. Edward S. Renwick, who may be said to have had the largest experience of any man (living or dead) as an expert in patent cases, in his recent work, "entitled, "Patentable Inventions," says, p. 1, section 2: "As to what constitutes invention the following dictum was pronounced, in 1880, by the United States Supreme Court

(Pearce *vs.* Mulford, 102, U. S., 112, 26, L. ed. 93) : 'but all improvement is not invention and entitled to protection as such. Thus to entitle it, it must be the product of some exercise of the inventive faculties.'" "What these faculties are," says Mr. Renwick, "or how they are to be distinguished from the constructive faculty of the mind, is a matter that is left by the court in profound obscurity. No two persons can agree as to the line of demarcation between the two faculties, because from the variations in the characters of the minds of men, their differences in training and in experience, a change which to one mind appears to have involved the exercise of the so-called inventive faculty, is thought by another (*after* the event) to have been the result of merely the constructive faculty or of mechanical skill. Hence, to test the existence of invention by the assumption of the exercise of mental faculties by which it has been produced, and which are indefinable, amounts simply to an attempted determination of a truth by mere judicial opinion, without reliance upon evidence and without recourse to rules by which a just conclusion can be reached.

This certainly, of itself, would leave the subject in the state of chaos. Mr. Renwick very naturally deplores this condition of affairs, viewed as he views them, and fears that the creation of the present nine appellate courts will tend to multiply the construction of the law as to what constitutes invention, rendering it more diverse than even heretofore, unless these courts shall decide upon *some rule* by which invention can be determined. By reason of Mr. Renwick's large experience as a patent expert and solicitor of patents (although, I believe, he has never been admitted to the bar), his opinion is entitled to much respect, and it would be with great caution that any one would attempt to criticise the views of one of his years, ability and experience. He deplores the condition of affairs in any case wherein the question of invention is decided by the *mere opinion* of the court. "Formed in every case *after the event*, the matter is at once removed from the domain of evidence and is cast upon the sea of uncertainty, where it is subjected to the varying qualities and shifting views of the minds of judges, who, however, while trained in the science of the law, have, as a general rule, no personal experience in the operation of an inventor's mind." He favors the methods of the courts in the earlier decisions, as having been guided by certain definite rules in determining this important queston, while many of the later decisions of the highest court have determined the question upon mere opinion *after the event.* Mr. Renwick cites Earl *vs.* Sawyer (4 Mason, 1), as containing a rule by which invention may be determined, viz. :

Earl *vs.* Sawyer.—A change was decided to be *new* under the patent laws when it had not been known or used before. It was decided to be *useful* if it would accomplish the purpose for which it was designed, and was not noxious or hurtful.

Mr. Renwick says, p. 4 : "These *two* requirements of novelty and utility are clearly susceptible of proof by evidence; and it is deducible from the earlier decisions, and those which have followed in the same line, that a change which involves those requirements is an invention within the meaning of the patent law within certain well-defined exceptions." The exceptions which he notes in Section 6 are where the changes are simple and not sufficient to involve invention, such as a *mere change* in size or degree, in proportions, of material, of location or arrangement, the mere application of an old thing to a new purpose, the mere application of an old thing to perform its usual functions with its usual mode of operation or movement, mere substitution of an old device for another, a mere duplication of old devices, a mere change of the direction of movement of a moving device, the discovery of a new property of matter. This is not saying that changes do not involve invention, but that *mere* changes, or such as are so simple as to be within the knowledge of the ordinary skilled mechanic are not invention.

It is hard to say that the rule which Mr. Renwick seems to adopt, or at least suggests as the method of determining what is and what is not patentable invention, is itself an easy rule of guidance, viz. :

Under Earl *vs.* Sawyer, *supra*, invention equals a change not known or used before (it being understood that the change is not a *mere* change of size, proportion, etc., such as noted in the exceptions referred to) ; and, secondly, the change must be useful, and is useful if it accomplishes the purpose for which it was designed, and not noxious or hurtful. These two requirements of novelty and utility are stated to be susceptible of proof by evidence.

This rule may be as positive, with the exceptions noted, as it is possible to formulate, but it is certainly not infallible. The exceptions themselves form such a very broad class that one or more of them are apt to enter into the consideration of almost every case where there is any doubt ; and again, the exceptions to the exceptions, which are noted on pp. 5 to 40, in the cases therein cited, render the rule still more difficult of application, so that we are unwillingly obliged to agree that Mr. Walker is not far from right when he states, in his work on patents, section 24, before quoted, that the ideal line which separates things invented from things otherwise produced has never been completely defined or described. There is no affirmative rule by which to determine the presence or absence of invention in either case ; and with Robinson and others, that what is invention is perhaps incapable of exact definition.

It is true the thing must be *new* and must be *useful* to constitute a patentable invention ; the mere fact that it is useful does not make it *new*, but everything that is new, and is sufficiently worth fighting for, to get into the courts, is generally *useful*, and consequently this question of utility does not usually seriously hamper the judges in their decisions.

ELECTROLYZED WATER PIPES.*

BY J. S. FURAY.

In some instances of pipe corrosion, a spot of greater or less extent is singled out by a current and weakened until it becomes detached like a chip. These electrolyzed nodules are extremely light. Four samples examined by me gave a specific gravity of 2.36, 2.06, 1.88, 1.54. The latter resembled coke in weight and appearance. Bearing in mind that the specific gravity of cast iron is 7.00, we may naturally enquire what has become of the iron? and what changes have taken place? This question was referred to me for solution. In order to follow the most rational method, it occurred to me to subject these nodules to the same electrolytic action which they had undergone.

We have under our streets an extensive plating battery in constant operation, of which the water pipes are presumed, in our case, to be positive, the rails negative and the intervening earth solution. Wherever there is a difference of potential, that is, wherever the water pipes carry a stronger current than the rails, the electricity will flow from the higher to the lower, from the positive to the negative metal through a conducting medium, carrying metal from the higher potential towards the lower, either depositing it on to the negative pole or dropping it on the way. Acting on this underlying principle of electrolysis, a nodule previously weighed was attached to the positive pole of the trolley current, after it had done its work, suspended in dilute hydrochloric acid, while at the distance of a few inches was the negative pole, consisting of a platinum plate connected with the water pipe. On closing the circuit a flow of electricity could be seen passing from the iron nodule through the solution towards the negative platinum, carrying with it into the solution iron particles, as could be seen by the decomposition of the solution into hydrogen and chlorine, the hydrogen escaping by the negative pole and chlorine combining with the free iron to form iron chlorine. The liquid was occasionally renewed and tested for iron, till after five days it gave no further reaction with sulphocyanide of potassium, thus indicating that the nodule had no more iron to furnish. After drying it in an air bath it was weighed. The loss of weight was iron 56 per cent. Now, if the piece of electrolyzed iron had lost

* Abstract of report on the Analysis of the Water Pipes of Omaha, read a the Montreal meeting of Fire Chiefs.

all its iron, the solution of iron chloride had gained and therefore should contain as much. This was actually the result, titration by potassium bichromate being the method employed.

The nodule deprived of its iron retained its former shape, but was extremely light and frail. It was, in fact, but the ghost of its former self, Was it carbon? An analysis gave 29 per cent. graphite, 13.37 silicon and 1.15 manganese with traces of sulphur and phosphorus, hence the complete analysis of the electrolyzed pieces of cast iron pipe would be:

Iron, 56.19; graphite, 29.00; manganese, 1.15; silicon, 13 37; sulphur, phosphorus, etc.,—; total, 99.71. Specific gravity, 1.88.

Compare with this the composition of a fair sample of (grey) cast iron.

Iron, 90.58; graphite, 3.70 to 6; silicon, 4.14; manganese, 0.83, sulphur, phosphorus, etc., small; total, 99.25. Specific gravity, 7.00.

We can now readily understand how, under the action of electrolysis, our city service pipes have much of the iron, their backbone of strength corroded away, leaving behind in its place a frail shell of graphite iron, incapable of sustaining even the usual pressure of the mains.

That the above results appear to be warranted, is confirmed by an analysis of the earth around the electrolyzed parts. Several samples of earth were found to have gained as much iron as the pipe had lost.

It should be borne in mind that the above analysis is not intended to be a representative one of all similar spots of corrosion. Three other samples examined gave varying percentages of iron and graphite, one being so very light, unctious to the touch, incombustible and of such greying black metallic lustre that I would almost call it pure graphite. It was a good conductor of electricity, burned like the carbon of an electric lamp, marked paper like a soft lead pencil and coated a platinum dish with the unctious black of stove polish.

NATIONAL ELECTRIC LIGHT ASSOCIATION.

THE CLEVELAND MEETING.

We have received from Secretary Geo. F. Porter, of the National Electric Light Association, a partial list of the papers to be read at the Cleveland meeting of that Association, on February 19, 20 and 21, 1895.

The list is as follows:

Some Economies in Electric Light and Power Stations, by Edward Weston.

Arc Carbons and the National Electric Light Association Standard of Light, by L. B. Marks.

The Monocyclic System, by Dr. Louis Bell.

The Correct Method of Protecting Electric Circuits, by W. E. Harrington.

The Evolution of Arc Lighting Machines, by C. N. Black.

Mr. E. A. Leslie's paper, read at the Buffalo meeting, and entitled "The Operation of High Tension Currents From a Physical and Financial Standpoint," will be taken up and discussed.

ELECTRICITY ON THE ELEVATED ROADS.

A dispatch from Pittsburgh, December 26, states that it was rumored there at that time that the Westinghouse Electric and M'f'g Co. was about to contract with the Manhattan Elevated Railroad Company, of New York City, to furnish electrical equipment for the elevated system. Mr. Russell Sage, for the Manhattan Elevated Railroad, denied the truth of the report. He says, however, that, as old as he is, before he dies he expects to see electricity used as motive power on the elevated railroads and for all classes of work in connection with their operation.

(*Continued from Page 4.*)

in some cases by fixed hydraulic, gas or steam motors. The principal disadvantage common to all lines worked by component of gravity consists in the excessive additional dead load due to the water ballast, which entails not only a great deal of additional brake power *per se*, but a variety of complicated safety brakes, involving very careful manipulation; while the three systems of fixed motors are either uneconomical, or unwieldy and obsolete. The superior advantages of cable traction by electrical motors, as compared with all the other systems referred to, have been attested by three lines in Switzerland, all of which have been constructed within the last four or five years—to wit, the Burgenstock, on the Lake of Lucerne; the Monte Salvatore, on the Lake of Lugano, and the Stanserhorn, near the Lake of Lucerne, which last named was opened for traffic only last year. It is not the purpose of this paper to give a detailed description of these lines; suffice it to point out their salient, and more especially their electrical features.

(*a*) *Burgenstock.*—The summit level of this line is 2,884 feet above the sea, the total rise being 1443 feet in a little over 1,000 yards, the minimum grade 32, and the maximum 58 per cent. Electric motive power for working the cable and cars is obtained by high-tension (1,600 volt) transmission from a hydro-electric power station 2.5 miles distant, the output of the two series-coupled direct-current Thury dynamos, driven by a high pressure turbine, being 40 kilowatts, or 60 h. p. Two corresponding series-coupled motors at the summit of the cable railway drive the cable winding drum through belt, countershaft. and bevel gearing; the total reduction being 700 to 5 revolutions, or 140 to 1, corresponding to the regulation car speed of about three miles per hour. The speed is regulated from the motor station, and not by the driver, except in case of emergency.

(*b*) *Monte Salvatore.*—This line has a summit level of 2,900 feet, the rise being 2,000 feet in a length of 1.2 mile, the initial grade at the base 17, and the maximum at the summit 60 per cent. The motor station is situated midway up the incline, and the power is derived by a 2,000-volt transmission from a large hydro-electric 1,500-h. p. power station five miles distant. The output of the Oerlikon (Brown) direct-current generator, driven by a high-pressure turbine, being 60 kilowatts. The corresponding motor on the line drives the cars and cable in precisely the same way as on the preceding line, except that the Salvatore incline is worked in two sections.

(*c*) *Stanserhorn.*—This line ascends an altitude of no less than 6,200 feet above sea-level, and has a total rise of 4,570 feet in a length of 2.5 miles, worked in three sections, having maximum gradients of 30, 60 and 62 per cent. respectively. The requisite power per car is 40 h. p., and a motor station is placed at the summit of each section. The three Thury motors actuate the winding drums as before described, and are fed from the same power station as the Burgenstock line, but by a separate high-tension (2,000-volt) transmission 2.5 miles in length. The total efficiency on this, as on the other lines, is about 60 per cent.

(*d*) *Conclusions.*—The three lines of which I have given a necessarily very incomplete *résumé* mark a conspicuous advance in cable traction. As compared with haulage by the other systems referred to, they show a saving in car weight of no less than 50 per cent., the full car load with 36 passengers being in the former case 12 to 15 tons, and on the electrically-worked lines only six to seven tons. Again, the average cost of construction of the Swiss cable railways worked on the older systems is no less than £41,000 per mile, whilst that of the electrical lines is only £24,000 per mile, or 40 per cent. less. Similarly, the working expenses on the older lines vary, with one or two exceptions, between 60 and 80 per cent., whereas the electrical lines are worked at 45 per cent. of the receipts. These three lines also show a remarkable development due to electrical traction *per se*, inasmuch as, apart from the unprecedented grades, up to 62 per cent., or 1 in 1.6, the length of the incline has been gradually increased from

1,000 to 2,200 and 4,500 yards, which, having regard to the mechanical work performed on the grades, is equivalent to 14, 20 and 44 miles respectively on the straight and level. And, lastly, the superior safety and smoothness of electrical working attested by the Burgenstock and Salvatore lines, has made it possible to dispense on the Stanserhorn incline with the rack used as a safety factor on its two predecessors; so that on Stanserhorn electrical traction has achieved the feat of scaling Alpine altitudes, which it was hitherto believed could only be reached by rack railways worked with special steam locomotives, such as those used on the neighboring mountain Pilatus, at more than double the cost per train mile.

TRACTION BY MOTOR CARS OR LOCOMOTIVES WITH FIXED CONDUCTORS.

The first steep-grade railway worked by electrical traction with fixed conductors in Europe was the Florence and Fiesole line, opened in 1891. It was in succession followed by the Murren mountain railway, in Switzerland, opposite the Jungfrau; by the Mont Salève line, in Savoy, near Geneva; by the Genoa and then by the Zurich steep-grade road railways; and quite recently by a similar line at Barmen, in Rhenish Prussia. Of these lines, those of Florence, Murren, Genoa and Zurich have continuous grades of eight, five, seven and six per cent. respectively, and are worked as simple adhesion lines, with overhead contact wires, and return circuit by the electrically bonded rails: while the Salève and Barmen lines having continuous inclines of 25 and 18 per cent., or one in four and one in six respectively, are worked with the aid of a rack, and the former has an outside conductor rail in the shape of an inverted ordinary flange rail, while the latter has overhead contact. The Murren line is the only one worked with electrical locomotives; all the others are worked by single-motor cars.

(*a*) At Florence the power station, situated at the foot of the incline, comprises three Tosi boilers, three Oerlikon vertical compound 90-h. p. engines and three belt-driven Edison bipolar dynamos with a total effective power of 245 h. p., equal to 93 per cent. efficiency. The 12 motor cars are each fitted with two 20-h. p. spring-suspended and series-coupled Sprague-Edison motors, the original ones having double-reduction, the more recent ones single-reduction spur gearing. The contact is by trolley wheel and pole, and the total efficiency of the system is 66 per cent.

(*b*) On the Murren railway, whose altitude is 5,300 feet above sea-level, power is generated by a high-pressure turbine, which drives a direct-coupled Oerlikon (Brown) bipolar dynamo of 120 h. p. The power station is situated about midway of the line, the power being derived from the torrent of the celebrated Staubbach Fall. The four locomotives weigh 7.5 tons each and carry two 30-h. p. single-reduction spur-geared motors; the tractive force of each locomotive being about one-third of its weight, and the total efficiency of the system 68 per cent.

(*c*) The power station of the *Mont Salève* line (summit level, 3,700 feet above the sea) is situated about a mile from the line, and comprises two low-pressure turbines and two separately excited Thury multipolar dynamos mounted on the vertical turbine shafts, and giving, at the low turbine speed, 500 h. p., or only a quarter of their combined normal output of 2,000 h. p. The twelve motor cars are each fitted with two 30-h. p. four-pole Thury motors, with double spur gear reduction, and current is taken from the outside conductor rail by metallic slide contact shoes. Owing chiefly to the unnecessarily heavy gearing, the total efficiency is only about 52 per cent.

(*d*) At *Genoa*, the power station is about 1.3 miles distant from the line, and contains at present two boilers, two compound condensing Tosi 160-h. p. engines, and two belt-driven 110-kilowatt Siemens inner pole dynamos. The present line, which is the nucleus of a projected suburban system, is worked by six cars, each fitted with two 16-h. p. Siemens motors; the reduction being 10 to 1, by chain and toothed wheel. Current is taken from the overhead wire by two Siemens & Halske's rectangular metallic contact frames.

(*e*) The Zurich power station is placed at the upper end of the line, and comprises two boilers, two 100-h. p. Oerlikon vertical engines and dynamos, together with an accumulator battery of 300 Tudor cells for compensating the variations of load of the steam engine. The twelve motor cars are each fitted with two 12-h. p. Oerlikon motors. The total efficiency of the line is 65 per cent.

(*f*.) At Barmen the power station is situated at the foot of the incline, and contains two 225-h. p. compound condensing engines driving direct two Siemens inner-pole ring dynamos, whose output is 155 kilowatts each. The line is worked by ten motor cars, each provided with two 36-h. p. Siemens motors, which, by single spur gearing actuate the rack pinions mounted direct on the car axles. The total efficiency is, like that of the other lines, from 60 to 65 per cent.

(*g*.) *Conclusions.*—It is seen that the primary generating power is steam on the Florence, Genoa, Zurich, and Barmen, and hydraulic on the Murren and Mont Salève lines; the dynamos being direct-driven in four, and indirect in the other two cases. Notwithstanding the high cost of fuel in Italy and Switzerland (as much as 30s. per ton), and the steep grades on the Florence, Genoa and Zurich lines, the running expenses do not exceed 4.5 pence per car mile; while the total working expenses, including administration and renewals, are within 7.5 pence per car mile, or about 50 per cent. of the receipts. On the Murren and Salève lines the cost of hydraulic power per annum is, of course, restricted only to wages and repairs. In the former case the working expenses do not exceed 40 per cent. of the receipts; while in the latter they are as much as 80 per cent., this high rate being due chiefly to inadequate fares. A specially noteworthy feature is the steady speed of eight to ten miles per hour with which motor cars run up the steep adhesion inclines of six, seven and eight per cent. at Zurich, Genoa and Florence; while on the descent a speed of even 15 miles per hour has proved perfectly safe, in conjunction with the powerful and instantaneous action of the electric safety brake constituted by the motors acting as dynamos on the descent, although, for ordinary purposes, even the mechanical brake alone suffices to stop the car within its own length.

As regards the comparative working cost of steep-grade adhesion or rack railways by steam and by electricity, I can affirm from my own experience, as well as from every other case which I have had occasion to investigate, that, irrespective of the immensely greater elasticity of the service, and consequently the far more rapid development of the traffic, electrical working ensures an economy of at least 50 per cent. as compared with steam.

GENERAL CONCLUSIONS.

With regard to electrical traction on flat, as well as steep-grade lines generally, I am led to the following conclusions:

Direct and Indirect Driving of Generators.—Although direct driving, whether by steam engines or by turbines, is the ideal standard, and therefore, always preferable, it cannot, for tractive purposes, be laid down as a dictum *à priori.* On lines having steep, and more especially alternately rising and falling grades coinciding with sharp curves, an intermittent traffic, and frequent stoppages, the variations of load are so great and so rapid—often from zero to maximum in the space of one minute—that vertical high-speed engines suitable for direct driving generally work very economically. This is, *e. g.*, the case at Florence, and in an even greater degree at Marseilles, where high-speed direct-driving engines had actually to be replaced by horizontal low-speed Corliss engines, with belt-driving. In the case of hydraulic power high pressure turbines always admit of economical direct driving, whereas low pressure turbines involve for direct driving proportionately larger dynamos, giving only part of their normal output, so that here, too, indirect driving by gearing or belt is generally more economical. The same applies where gas engines are used.

Gearless and Geared Motors.—Gearless motors are eminently suitable for high speeds, while for low speeds they require to be of inconveniently large size. For geared

motors single reduction is, of course, always preferable, although on exceptionally steep grades where the motors have to develop their maximum power at minimum car speed, double reduction may in some cases be unavoidable. In any case, spur gearing is always preferable to worm gearing or chain motion, both of which involve too much friction and consequent loss of power.

Parallel and Series Coupling of Motors. — This much-debated question cannot be decided *à priori*, but depends on individual cases. For level or easy-grade lines parallel coupling is more suitable; whereas on steep grades, where starting requires always the maximum torque, series coupling is generally called for.

Variations of Load.—On lines with steep or rising and falling grades, these variations cannot be mitigated, much less equalized, simply by increasing the number of cars or trains on the line, since the variations are caused not only by the varying traffic, but by the varying grades and curves, and by the varying degrees of adhesion, more especially in starting. Where separately excited dynamos are used, a partial means of compensating the variations of load is, as well known, that of varying the excitation by the main current passing through the exciter. But the most effectual remedy is the addition of an accumulator battery, which absorbs an excess of supply from the generator over demand on the line, and, *vice versa*, makes up for any deficiency of supply, so that the steam-engine and generator can always run at full and constant load. Accumulator batteries have fully vindicated their claim as an important auxiliary and as a means of economical working of traction installations at Zurich, and subsequently in the Isle of Man, and well repay the additional first cost of plant.

Continuous and Alternate Current.—Hitherto continuous current has been exclusively used for electrical traction. But, having regard to the high degree of efficiency and perfection and the ease of starting recently attained in alternate-current motors, thanks notably to the persevering efforts of such constructors as Messrs. Brown, Boveri & Co., it may be confidently predicted that, as in lighting installations and in power transmissions for industrial purposes, so also in electrical traction alternate is destined to supplant continuous current. Alternate current, whether single or multiphase, will not only admit of electrical traction being applied over much longer distances than is economically possible with continuous current, but it will ensure a saving of something like 30 per cent. in the weight of dynamos and motors, irrespective of the saving in copper of feed and contact wires, and will thus considerably simplify and cheapen electrical installation and equipment for tractive purposes. But whether by alternate or by direct current, on flat as on steep-grade lines, on so-called light railways as on tramroads in town and country, we may be well assured that electrical traction in its various forms has, both in this United Kingdom and throughout Europe, a brilliant and triumphant future.

PERSONAL.

James F. Kelly, well known to the electrical trade as late general manager of the wire department of the General Electric Company, has received the appointment of sales agent of the New York Insulated Wire Company, 15 Cortlandt street, New York City. Mr. Kelly has been associated with the electrical business for many years, and no one in it has more friends than he. The New York Insulated Wire Company is to be congratulated in securing the services of so able a gentleman, and Mr. Kelly no doubt will ably maintain the reputation of the concern he will hereafter represent. Mr. Kelly is one of the pioneers in the telephone business and was, later, connected with the Western Electric Company. We wish him success.

Mr. F. H. Angell, who has for the past ten or twelve years been intimately associated with the electrical trade as wire salesman, railway supply manufacturer, etc., has completed arrangements with the C. & C. Electric Co., 143 Liberty street, New York, to represent that company. Mr. Angell possesses all the qualities necessary in the successful salesman, and no doubt the C. & C. Electric Company will find his services of great value to their interests. Mr. Angell was connected with the Utica Electrical Supply Company, Utica, N. Y., a year or more ago. He has recently been engaged in selling a special line of goods and the concern he represented were satisfied beyond measure with the success he met with. Mr. Angell will be welcomed back to the electrical trade with pleasure, as he is highly esteemed among his old friends, and the C. & C. Company is to be congratulated in its good fortune in having with it so worthy a gentleman.

PETITION OF THE CONSOLIDATED TRACTION CO.'S EMPLOYÉS.

The employés of the Consolidated Traction Co., Jersey City, Newark and the Oranges, N. J., have presented a petition to President E. F. C. Young, of that company, for an increase of wages and the redress of certain grievances.

The petition is a strong one, and the facts are well presented. The following is a copy of the same:

"DEAR SIR: With your kind permission, we, the employés of the Consolidated Traction Company, do respectfully make application to your honorable Board for an increase of wages. We submit that we, the motormen and conductors, are not properly compensated for the amount of labor done, as the company compels every employé to procure a uniform and to pay for damages done, which occur occasionally to us all. Thus, we claim, we are poorly compensated, particularly the trippers and the night forces on the various lines.

"We ask for a standard wage and time schedule, that is, when one enters the service of this company he be paid at the rate of $2 a day, whether he be an extra or a day man, and that no man shall work more than ten hours inside of twelve consecutive hours. That all suspended employés be paid half time, provided they are not, after careful hearing, found at fault. That all employés shall have twenty-four hours' notice of all necessary changes of time-tables.

"That on special occasions, when the tripper or an extra man takes a car out of the house, he shall not receive less than 25 cents for one hour's work, or part of an hour; $1 for four hours' work, and so on; and if he works over eight and his car is taken off the road, he shall be paid a full day's pay.

"All motormen and conductors not to receive less than $2.50 for ten hours' work on sweepers and snow ploughs, and their helpers not to receive less than $2.25 for the same time. That all employés shall have an impartial trial, the accused to be represented at the hearing as well as the company. That the order just issued compelling employés to pay their fares while in uniform going to and from work be rescinded. That all motormen and conductors on regular night trippers be paid not less than $1.75 per night. That no employé be held responsible for any accident that might occur on his car, such as the breaking down of any of the mechanism or giving out of any of the electrical appliances while on the road. That all employés in the discharge of their duties shall be properly and respectfully treated by starters and other officials.

"That conductors and motormen shall not lose any part of their pay in case of a block caused by fire, breakdown, etc. That the company shall employ no person as motorman or conductor who is not conscientiously deemed fit by the conductor or motorman who is breaking him in. This is to improve the general tone of the employés, and will be of much more benefit to the company than to the men in the long run. That the night trippers get a day's work in their order as they are entitled to it when day men lay off, are sick, or are suspended, and that the extras run the night trippers' cars, they also to get a night's work in their order, as they are entitled to it. By doing this it will be a great boon to the night men, as at present if they are off for the night they lose a night's pay. This was the

old system on all the lines, and at present it works satisfactorily on the Erie street line.

"That the company use the envelope system in paying its employés.

"That the company shall provide a place at the different depots for their employés to dine in, keep their stormy weather clothes in, to sit while waiting for their cars, to make out their reports, and other facilities. This will also tend to very much improve the habits of the employés.

"That no employé shall be compelled to work when not able, and that it shall not require a doctor's certificate to put him on the sick list. Also if an employé be found, after having been off sick, to be shamming, that he go to the bottom of the list or be dismissed. That the oldest man on the road be first for promotion, whether it be permanent or temporary."

President Young has promised to submit the petition to the directors for their consideration, and the men will await their action before making any further move in the matter.

MODERN THEORIES AS TO ELECTRICITY.*

BY HENRY A. ROWLAND.

We come to the conclusion, then, that all electrification is originally produced by separating the atoms of bodies from one another, which can be done by breaking contact, by friction, or by direct chemical action of one substance on another, or in some other manner not so common. The lines of electrostatic force in a case of electricity at rest must always begin and end on matter, and they can never have their ends in space free from matter. The ends can be carried along with the matter, constituting electric convection, or they can slide through a metallic conductor or an electrolyte or rarefied gas, making what we call an electric current; but, as they cannot end in a vacuum, they cannot pass through it. Thus we conclude that a vacuum is a perfect non-conductor of electricity.

The exact process by which the ends of the lines of force pass through and along a conductor can at present be only dimly imagined, and no existing theory can be considered as entirely satisfactory. In the case of an electrolyte, however, we can form a fairly perfect picture of what takes place as the decomposition goes on. Thus, in the case of zinc and copper in hydrochloric acid, we can imagine the zinc plate attracting the chlorine of the acid, thus stretching out the natural line of electric force connecting the chlorine atom and the first hydrogen atom; we can imagine the atoms of chlorine and hydrogen in the body of the liquid recombining with each other and their lines of force uniting until they form a complete line long enough to stretch from the zinc to the copper plate; and all without once making a line of force without its end upon matter. We can further imagine the ends of this line sliding along the copper and zinc plates to the conducting wires and down their length, thus making an electric current and carrying the energy of chemical action to a great distance.

If the ends of the lines should slide along the wire without any resistance, the wire would be a perfect conductor; but all substances present some resistance, and in this case heat is generated. This we always find where an electric current passes along a wire; as to the exact nature of this resistance or the nature of metallic conduction in general we know little, but I believe we are approaching the time when we can at least imagine what happens in this most interesting case.

Besides the heating due to the electric current, steadily flowing, we must now account for the magnetic lines of force surrounding the current and the magnetic induction of one current on the other.

If the current is produced by the ends of the tubes of electrostatic force moving along the wire, then we may imagine that the movement of the lines of electrostatic force in space produces the lines of magnetic force in a direction at right angles to the motion and to the direction of the lines of electrostatic force. At the same time we must be careful not to assume too readily that one is the cause and the other the effect; for we well know that a moving line of magnetic force (more properly induction) produces, as Faraday and Maxwell have shown, an electric force perpendicular to the magnetic line and to the direction of motion. Neither line can move without being accompanied by the other, and we can, for the moment, imagine either one as the cause of the other. However, for steady currents, it is simpler to take the moving lines of electrostatic force as the cause and the magnetic lines as the effect.

We have now to consider what happens when we have to deal with variable currents rather than steady ones.

In this case we know from the calculations of the great Maxwell and the demonstrations of Hertz that waves of electromagnetic disturbance are given out. To produce these waves, however, very violent disturbances are necessary. A fan waved gently in the air scarcely produces the mildest sort of waves, while a bee, with comparatively small wings moved quickly and vigorously, emits a loud sound.

So, with electricity, we must have a very violent electrical vibration before waves carrying much energy are given out.

Such a vibration we find when a spark passes from one conductor to another. The electrical system may be small in size, but the immensely rapid vibrations of millions of times per second, like the quick vibration of a bee's wing, sends out a volume of waves that a slowly moving current is not capable of producing. The velocity of these waves is now known to be very nearly 300,000 kilometers per second. This is exactly the velocity of waves of light, or other radiation in general, and there is no doubt at present in the minds of physicists that these waves of radiation are electromagnetic waves.

By this great discovery, which almost equals in importance that of gravitation, Maxwell has connected the theories of electricity and of light, and no theory of one can be complete without the other. Indeed they must both rest upon the properties of the same medium which fills all space—the ether.

Not only must this ether account for all ordinary electrical and magnetic actions, and for light and other radiation, but it must also account for the earth's magnetism and for gravitation.

To account for the earth's magnetism, we must supposs the ether to have such properties that the rotation of ordinary matter in it produces magnetism. To account for gravitation it must have such properties that two massee of matter in it tend to move toward each other with the known law of force, and without any loss of time in the action of the force. We know that moving electrical or magnetic bodies require a time represented by the velocity of light before they can attract each other in the line joining them. But, for gravitation, no time is allowable for the propagation of the attraction.

But the problem is not so hopeless as it at first appears. Have we not in two hundred and fifty years ascended from the idea of a viscous fluid surrounding the electrified body and protruding arms outward to draw in the surrounding bodies to the grand idea of a universal medium which shall account for electricity, magnetism, light, and gravitation?

The theory of electricity and magnetism reduces itself, then, to the theory of ether and its connection with ordinary matter, which we imagine to be always immersed in t. The ether is the medium by which alone one portion of matter can act upon another portion at a distance through apparently vacant space.

There is one trouble about the ether which is rather difficult to explain, and that is the fact that it does not seem to concentrate itself about the heavenly bodies. As far as we are able to test the point, light passes in a straight line through space even when near one of the larger planets, unless the latter possesses an atmosphere. This could hardly happen unless the ether was entirely incompressible or else possessed no weight.

* Abstract from *Engineering Magazine*, January, 1895.

If the ether is the *cause* of gravitation, however, it is placed outside the category of ordinary matter, and it may thus have no weight although still having inertia—a thing impossible for ordinary matter where the weight is always exactly proportional to inertia.

Ether, then, is not matter, but something on which many of the properties of matter depend.

It is curious to note that Newton conceived of a theory of gravitation based on the ether, which he supposed to be more rare around ordinary matter than in free space. But the above considerations would cause the rejection of such a theory. We have absolutely no adequate theory of gravitation as produced by the ether.

To explain magnetism, physicists usually look to some rotation in the ether. The magnetic rotation of the plane of polarization of light together with the fact of the mere rotation of ordinary matter, as exemplified by the earth's magnetism, both point to rotation in the ether as the cause of magnetism. A smoke ring gives, to some extent, the modern idea of a magnetic line of force. It is a vortex filament in the ether.

GODFREY, HARRINGTON & OLSEN.

Between two and six o'clock on the afternoon of December 31 last, the offices of Messrs. Godfrey, Harrington & Olsen, 15 Cortlandt street, New York, were for that space of time the *Mecca* of the electrical fraternity. The cause of this incident was a card sent out by the gentlemen named, of which the following is a copy :

New York, December 29, 1894.

Messrs. J. W. Godfrey, F. W. Harrington, J. B. Olsen, present their compliments and request the pleasure of your presence at their new offices, Monday, December 31st, '94, between two and six p. m., 15 Cortlandt street, Room 52.

Promptly at two o'clock a large crowd presented itself to congratulate the new concern and to wish it success in its new undertaking. Messrs. Godfrey, Harrison & Olsen were on hand and gave each caller a hearty shake of the hand. That they were kept extremely busy it is needless to say, and their countenances beamed with delight as they listened to the well-wishes of their many friends. In one of the rooms refreshments and cigars were provided for the callers and a hearty good time was enjoyed by all.

About every one in the electrical trade made it his business to drop in and help start the trio in their new departure, and the rooms were at all times filled with familiar faces.

The new firm is very confident of support from the trade, and when the reputation of each of the individual members is considered there is no reason why it should not be successful.

Messrs. Godfrey, Harrington & Olsen have the best wishes of The Electrical Age for their success.

New Corporations.

The Anderson Telephone Co., Anderson, S. C., by J. L. Mauldin and R. L. Levy and L. P. Brock. Capital stock, $1,000.

The Corsicana Mutual Telephone Co., Corsicana, Texas, by Jas. Garrity, A. N. Drane, S. A. Pace, C. W. Jester and Jas. L. Autry. Capital stock; $10,000.

The New Martinsville and Mannington Telephone Co , New Martinsville, W. Va., by Chas. W. Barrack, of New Martinsville, W. S. Barrack, of Burton, John E. Poe and A. M. Crowe, of Littleton, and Amos Jolliffe, of Uniontown. Capital stock, $20,000.

The Florissant Avenue Electric Railway Co., St. Louis, Mo., by John H. Schroeder, of 308 N. 14th street, T. P. Bell, of 925 Chestnut street and others.

The Susquehanna River Electric Co., Conowingo, Md , has been incorporated by M. H. Houseman, Geo. K. McGaw, John S. Bull and Winfield J. Taylor, of Baltimore, and Chas. R. McConkey, of Peach Bottom, Pa. Capital stock, $100,000.

The Flushing and College Point Electric Railway, by Daniel Odell, E. Bayard Halstead, Paul D. Cravath, John W. Houston, Victor K. McElheny, Jr., Frank A. Dillingham, Philip F. Kobbe, Harvey Romer and Chas. Snow Kellogg, of New York City.

The Home Heating and Lighting Company, Toledo, Ohio, by Homer F. Yaryman, R. W. Smith, Irving B. Hiett, E. L. Barber, W. B. Geroe and J. F. Zahn. Capital stock, $30,000.

The Acme Electric Company, East Palestine, Ohio, by Geo. E. Sebring, R. N. Chamberlain, D. H. McIntosh, Chas. Beyer and R. S. Chamberlain. Capital stock, $10,000.

The Cincinnati, Hamilton, Middleton and Dayton Street Railroad Company, Cincinnati, Ohio, by A. Hickenlooper, Chas. Fleischman, H. H. Hoffman, Henry B. Morehead, Oren Butt Brown and L. C. Weir. Capital stock, $500,000.

The Southampton Electric Light Company, Southampton, L. I., N. Y., by W. D. Van Brunt, H. M. Howell and Daniel Vail. Capital stock, $5,000.

The Wisconsin Interurban Railroad Company, Appleton, Wis., by A. L. Smith, of Appleton, as president, and others. Capital stock, $1,000,000.

The Manhattan Alarm Company, New York, by Albert S. Williams, Herbert N. Hansen, William H. Thitchener, John J. Dwyer and Frank L. Ryan, of New York City. Capital stock, $20,000.

The Potts Machinery Supply Company, Columbus, Ohio, by William B. Potts, Walter B. Page, I. N. Hasbrough, Chas. I. Scheaf and Isaac B. Potts. Capital stock, $10,000.

The Wichita Falls Construction Company, Wichita Falls, Tex., by J. A. Kemp, A. D. Anderson and A. S Stinnett. Capital stock, $25,000.

Possible Contracts.

There is talk in Jonesboro, Ark., of constructing an electric light plant and water works. The Mayor of that place can give further information.

The Mayor of Siloam Springs, Ark., can give information regarding the franchise secured by a company for an electric light plant and water-works in that place.

The city of Tampa, Fla., will establish an electric light plant. For further information address the Mayor.

A. B. Hurt, John W. Muncaster and A. J. Miller, comprising a committee, in Henderson, Ky., are looking for the best system for electric lighting the city.

Guild & White, Chattanooga, Tenn., have received the contract to construct an electric light plant and water-works system in Paris, Tenn. Work will be commenced in April next.

Contracts for the erection of the exposition buildings at Atlanta, Ga., have been let as follows : manufacturers' building, to A. W. Wilson, Cincinnati, Ohio ; machinery building to the Atlanta Building Company, Atlanta, Ga ; the forestry and mining building to the same ; the agricultural building to Grace & Hyde, of Chicago ; and the electricity building to Gude & Walker, Atlanta, Ga.

The Big Four Railroad, it is reported, will erect a new station at Louisville, Ky.

An ordinance has been introduced by the New Orleans City Council for the appropriation of $100,000 for a new court house. The Mayor can give further information.

The St. Charles Hotel Company, New Orleans, La., has obtained a permit to erect a new hotel which will cost $500,000.

The Mt. Washington Electric Railroad Co., Baltimore, Md., has been granted a franchise to build a trolley line. Mr. Geo. R. Webb is president and general manager.

The Drake & Stratton Company, Columbus, Ga., has the contract to build two miles of electric line for the Rose Hill Electric Railroad.

It is reported that Philadelphia capitalists are considering the idea of extending the proposed electric line to Williamsport, Md., from Hagerstown, Md.

The Jackson and Suburban Street Railroad Company, Jackson, Tenn., contemplates doing its own construction work, and is in the market for material, etc. Further information can be obtained by addressing J. H. Hunter, president.

It is reported that the Mobile and Spring Hill Street Railroad will be changed to electricity. M. P. Levy, Mobile, Ala., can give further information.

The Orleans Street Railroad Co., New Orleans, La., intends to change its line to the trolley system and will soon advertise for bids. President P. Cougot can give further information.

The City Passenger Railway Co., Baltimore, Md., contemplates the purchase of new cable cars.

The Atlanta Electric Railway Co., Atlanta, Ga., wants two electric launches.

The Atlanta Electric Railway Co., Atlanta, Ga., is ready to receive bids for the construction of eight miles of road, including power plant.

The Fort Worth Street Railroad Co., Fort Worth, Texas, is about to purchase some new cars.

Mr. Long, of Beaufort, S. C., has organized a company for the establishment of an electric light plant in that place.

The Mayor of Webb City, Mo., can give information regarding the proposed vote on the question of issuing bonds for the establishment of an electric light plant in that place.

The State Armory at Binghamton, N. Y., is to be lighted by electricity.

It is reported that the Houston General Electric Company, Houston, Tex., is about to begin the manufacture of incandescent lamps in connection with other electrical articles which they now make.

New York Notes.

Office of the Electrical Age,
World Building, New York,
December 31, 1894.

Judgment for $3,481 was entered against the Metropolitan Magneto Fire Alarm Company, of 108 Fulton street, this city, in favor of Frederick Martin, for money loaned. Mr. Martin is the president of the company, which was incorporated in March, 1893, with a capital of $250,000.

Leonard Paget, the well-known electrical expert, whose offices are at 166 Elm street, was arrested on December 26, by the keeper of the hotel at which Mr. Paget resided. The charge brought against Mr. Paget was trying to evade payment of $776 board bill. Justice Hogan held Mr. Paget in $300 bail. Mr. Paget claims that he was going into the country to collect money, and was starting off with his hand satchel when he was arrested.

Judge Truax, of the Supreme Court, on December 26, rendered a decision in the matter of the construction and operation of the 34th street railroad. The judge decides in favor of the company, because it has, since the action was begun, obtained more than sufficient consents for the construction of the road.

Mayor Gilroy, on December 26, vetoed the franchise granted by the Board of Aldermen for the construction of a railroad through 86th street from Central Park to 10th avenue. The veto was based on the opinion from the Corporation Counsel that the franchise did not comply with the provisions of the amended railroad law.

The Board of Electrical Control held its last meeting of 1894 on December 28. The secretary reported that during 1893 and 1894 2,731 poles and 3,008 miles of wire had been removed. During the existence of the Board 20,003 poles and 26,328 miles of wire had been removed. There were still many wires illegally strung, and the District Attorney had been requested to prosecute those maintaining them. W. T. H.

Telephone Notes.

The Kent County Telephone System, of Chestertown, Md., has been sold to Chas. T. Westcott.

The Southern Bell Telephone and Telegraph Company has obtained a franchise to construct a telephone system in Aiken, S. C.

Hampton Dukes, Orangeburg, S. C., can give information regarding a proposed telephone exchange in that place.

New Telephone Companies.—Anderson Telephone Co., Anderson, S. C.

Corsicana Mutual Telephone Co , Corsicana, Tex.

New Martinsville and Mannington Telephone Co., New Martinsville, W. Va.

(See Possible Contracts for further details.)

TELEPHONE PATENTS ISSUED DECEMBER 25, 1894.

Telephone Index.—C. A. Orth, Trenton, N. J. (No. 531,-556.)

CALENDAR.

The Buckeye Electric Co., of Cleveland, Ohio, has issued a neat monthly calendar for 1895.

WOVEN WIRE BRUSHES.

The Belknap Motor Co., of Portland, Maine, are the patentees and manufacturers of the best woven wire commutatar brush on the market.

Trade Notes.

Messrs. F. W. Harrington and J. B. Olsen, individually, have sent out to the trade a circular announcing their connection with the India Rubber and Gutta-Percha Insulating Company, with offices at Room 52, 15 Cortlandt street, New York City. They are associated in the business with Mr. J. W. Godfrey. The India Rubber and Gutta-Percha Insulating Company are the sole manufacturers of Habirshaw's high grade standard core, also White Core, insulated wires, cables, etc. This company makes specialties of underground cables, plain or lead covered ; insulated wires for interior work, either conduit or concealed ; rubber covered line wires for high tension currents ; special fixture wires for electroliers, and telephone and telegraph cables of all sizes.

Electrical and Street Railway Patents.

Issued December 25, 1894.

531,310. Electric Cut-Out. Harry Hansen, Everett, assignor of one-half to Nils Olson, Maplewood, Mass. Filed Jan. 23, 1894.

531,331. Trolley. Charles E. Powell, Philadelphia, Pa. Filed Oct. 31, 1894.

531,351. Flexible Gear for Electric-Car Trucks. Ferdinand A. Wessel and Ernst Egger, New York, N. Y., assignors of one-fourth to Aaron Naumburg, same place. Filed Sept. 22, 1893.

531,354. Electric-Conductor Support. Johan M. Andersen, Boston, Mass., assignor of one-half to Albert Anderson, same place. Filed July 9, 1894.

531,365. Controlling Electromagnetic Machines. William I. Donshea, New York, N. Y. Filed Jan. 29, 1894.

531,366. Means for Controlling Electric Locomotives. Ernst Egger and Ferdinand A. Wessel, New York, N.Y., assignors of one-fourth to Aaron Naumburg, same place. Filed May 17, 1893.

531,374. Car-Fender. William B. George, Columbus, Ohio. Filed Oct. 12, 1894.

531,380. Trolley-Catcher. Peter D. Milloy, Buffalo, N. Y. Filed Apr. 2, 1894.

531,383. Trolley. George A. Newhouse, New Albany, Ind. Filed July 28, 1894.

531,391. Life-Guard for Cars. Jakob Schneider, New York, N. Y. Filed July 11, 1894.

531,395. Car-Fender. Alonzo D. Smith, Newark, N. J. Filed Sept. 8, 1894.

531,421. Electric-Lighting System for Railway Cars. Morris Moskowitz, Newark N. J., assignor to himself and Leon D. Adler, same place, and A. S. Adler, Philadelphia, Pa. Filed Aug. 10, 1894.

531,422. Electric-Arc Lamp. Edwin J. Murphy, New York, N. Y. Filed Feb. 16, 1894.

531,424. Electric Plug-Switch Augustus H. Palmer, Utica, N. Y. Filed Oct. 17, 1894.

531,432. Starting Alternating-Current Motors. Louis Bell, Boston, Mass., assignor to the General Electric Company, same place. Original application filed July 3, 1893. Divided and this application filed Mar. 12, 1894.

531,437. Trolley-Wire Bracket. Winfield S. Kline, Bolivar, and John B. Westhafer, New Philadelphia, Ohio. Filed Oct 17, 1894.

531,441. Electric Railway. Charles H. Macloskie, Schenectady, and Henry M. Brinckerhoff, Matteawan, assignors to the General Electric Company, Schenectady, N. Y. Filed May 17, 1894.

531,445. Electrical Connection for Railway Rails. Arthur J. Moxham, Johnstown, Pa. Filed June 2, 1894.

531,450 Conduit Electric Railway. William H. Swift, Boston, Mass., assignor of one-half to John H. McGrady, same place. Filed Apr. 27, 1894.

531,486. Dredging-Machine and Electrically-Actuated Bucket Therefor. Colcord Upton, Salem, Mass. Filed Oct. 15, 1894.

531,499 Electric Locomotive for Elevated Railways. Fritz B. Behr, London, England. Filed Feb. 27, 1894. Patented in England, July 19, 1893, No. 13,996; in France, Aug. 17, 1893, No. 232,301; in Belgium, Feb. 5, 1894, No. 108,409; in Switzerland, Feb. 7, 1894, No. 8,038; in Hungary, Mar. 2, 1894, No. 327; in Italy, Mar. 12, 1894, LXX, 155; in Austria, Mar. 15, 1894, No. 44/480, and in Austria-Hungary, Mar. 21, 1894, No. 47,158 and No. 9,815.

531,515. Hinge for Electric Apparatus. Arthur B. Davis, Elkridge, Md. Filed May 12, 1894.

531,556. Telephone-Index. Charles A. Orth, Trenton, N. J. Filed Sept. 18, 1894.

531,574. Spring-Bearing Car-Truck. William Sutton, St. Louis, Mo. Filed Jan. 13, 1894.

531,575. Truck for Electric Cars. William Sutton, St. Louis, Mo. Filed Feb. 19, 1894.

531,613. Sanding Device for Street-Cars William C. Fisher, Mount Vernon, N. Y. Filed Oct. 8, 1894.

531,614. Electric Cable. Theodore Guilleaume, Cologne, Germany Filed Apr. 26, 1892. Patented in Germany, Nov. 7, 1891, No. 65,930, and in England, Nov. 12, 1891, No. 19,630.

531,617. Automatic Rheostat. Rodolphus W. Hollis, Atlanta, Ga. Filed Apr. 30, 1894.

ELECTRICAL AGE

VOL. XV., No. 2. NEW YORK, JANUARY 12. 1895. WHOLE No. 400

ESTABLISHED 1883.

Entered at New York P. O. as second-class matter, January 18, 1891.

THE ELECTRICAL AGE PUBLISHING CO., PUBLISHER

TERMS OF SUBSCRIPTION:

One Copy, one year,	$3.00
One Copy, six months,	1.50
Great Britain and other Countries,	4.00

Cable Address (all Cables,) "Electage," New York.

W. T. HUNT, President F. N. BASSETT, Vice-President.

T. R. TALTAVALL, Secretary and Editor.

NEWTON HARRISON, E. E., Scientific Editor.

ADDRESS ALL COMMUNICATIONS TO

THE ELECTRICAL AGE PUBLISHING COMPANY,

FIRST FLOOR, WORLD BUILDING.

NEW YORK.

NEW YORK, JANUARY 12, 1895.

CONTENTS.

PRINCIPLES OF DYNAMO DESIGN.

Owing to the illness of Mr. Newton Harrison, that gentleman has been unable to prepare the manuscript for the next installment of his article on "The Principles of Dynamo Design." He expects, however, to have it ready in time to appear in our next issue.

THE BERLINER PATENT.

We reprint in this issue, in full, the specifications and claims of the two Berliner patents involved in the recent decision of Judge Carpenter, in Boston. In that decision the Judge decreed that the Berliner patent No. 463,569 was void on account of the issue to Berliner of a former patent on practically the same invention. We also reproduce the full drawings of each patent, so that the interested reader may compare point for point. Judge Carpenter decides that the two patents are for the same thing, therefore his decision stands as law with reference to this important matter until a higher court decides otherwise. To the lay reader the similarity between the two patents is remarkably striking, both as regards the language used in their description and in the drawings themselves, and it will require a very keen sense of discrimination to perceive any material difference. It seems to be a case of "distinction without a difference."

THE TELEPHONE BUSINESS.

It is safe to say that few persons, not including those who are directly engaged in the trade, have any conception of the magnitude of the telephone business in this country—we mean the business carried on outside of the Bell Company's field. We have endeavored to present in this issue a brief account of some of the representative companies that are working on lines independent of the Bell Company, and the result of our efforts gives a fair idea of the magnitude of operations in this industry. All the companies here represented are doing an excellent business, so they report, from which fact it is natural to infer that the great Bell monopoly is considerably harassed at many points. The Bell Company unquestionably enjoys a great many advantages that many of the newer companies do not yet possess, but no doubt the day will come when the latter will be on equal terms in these respects with the larger concern. Public feeling tends in that direction, and it is public sentiment that creates and shapes law. In our record of telephone concerns we have, for several and various reasons, not been able to include all. It was our desire to make an omnibus article, and our efforts were directed with that object in view, but several concerns hesitated about taking advantage of our offer, while others preferred to keep quiet and in the background. The absence of their names from among those of their lively competitors, as set forth in our columns, is due to their own inaction. When we undertake an enterprise of this character we make no discrimination in the selection of concerns who shall enjoy the benefits to be derived from such articles—all are treated alike. To the casual observer one fact impresses itself upon the mind after reading our record of telephone industries in this country, and that is, that the United States is a big country. All of these companies are prosperous and have plenty to do, in spite of the great prestige of the Bell Company. It is said that people live in France who never heard of Paris. We presume there are plenty of people in this country who never heard of the Bell Telephone Company, and although these enterprising independent companies need not go so far from the confines of civilization to find business, there is probably a large field yet to be developed in the direction indicated. Right in our own cities and towns opposition to the Bell Company in any form is welcomed, and it is not to be wondered at, then, that these newer concerns do well. They will do better all the time.

TELEPHONE INDUSTRIES OF THE UNITED STATES AND CANADA.

THE BERLINER PATENT.

In view of the great interest that exists concerning the Berliner patent which was declared by Judge Carpenter, in the United States Circuit Court, Boston, on December 18, last,* to be void, we give herewith, in full, the specifications and the claims of the two patents involved, together with the illustrations of each.

It will be remembered that Judge Carpenter, in his decision, held that the patent of 1891 was void on account of patent, No. 233,969, issued to Berliner on November 2, 1880, which was for practically the same invention. The judge says that "The whole apparatus is shown in the drawings of both patents and is identically the same in both." We will now let our readers judge for themselves; the correctness of the judge's assertion seems to be confirmed by a comparison of the two sets of illustrations.

Patent No. 233,969, Dated November 2, 1880.

ELECTRIC TELEPHONE.

Application filed September 3, 1880.

"*To all whom it may concern:*

Be it known that I, Emile Berliner, a resident of Boston, county of Suffolk, State of Massachusetts, have invented a new and useful improvement in electric telephones, which improvement is fully set forth in the following specification.

My invention consists in a new and useful improvement in telephonic receivers for producing sound by means of varying electrical currents, of which the following is a specification.

It is a fact and a scientific principle that if two electrodes be placed in contact to form part of a circuit and a current of electricity be passed through them a repulsion is exerted between them. Based on this fact I have constructed a simple receiver for an electric-telephone apparatus.

In figure 2 of the drawings, A is a metal plate well fastened to the wooden box or frame, but able to vibrate. Against the plate and touching it is the metal ball *c*, terminating the rod B, which rests on the bar or stand *d* and presses against the plate, which pressure, however, can be regulated by the thumb-screw attached to the ball.

If a current of electricity passes through the plate and the point of contact, or vice versa, a repulsive movement will take place between the plate and the ball, because both are charged with the same kind of electricity. This force of repulsion may be weakened or strengthened by varying the strength of the current. As that strength is varied by any appropriate form of electric speaking-telephone transmitter, (especially that shown at A B of the various figures of the drawings, and more particularly described and claimed by me in another application filed June 4, 1877, of which this is a division), so will also the force of repulsion at the point in the receiver be alternately weakened and strengthened as many times accordingly, and will therefore cause its plate to vibrate at the same rate and measure. The latter vibrations being communicated to the surrounding air, the same kind of sound as uttered against the transmitter, Fig. 1, will be reproduced at the receiver, Fig. 2, or in as many other receiving instruments as are situated within the same electric circuit.

In Fig. 2 I have shown the receiver as consisting of a diaphragm in contact with a ball. In Figs. 3 and 4 I show it as somewhat differently mounted, and with the contact-piece in the form of a pin instead of a ball, and in Fig. 6 in a still different form with a carbon contact. In this figure W is a piece of carbon.

In Fig. 5 two plates in contact at their edges are shown.

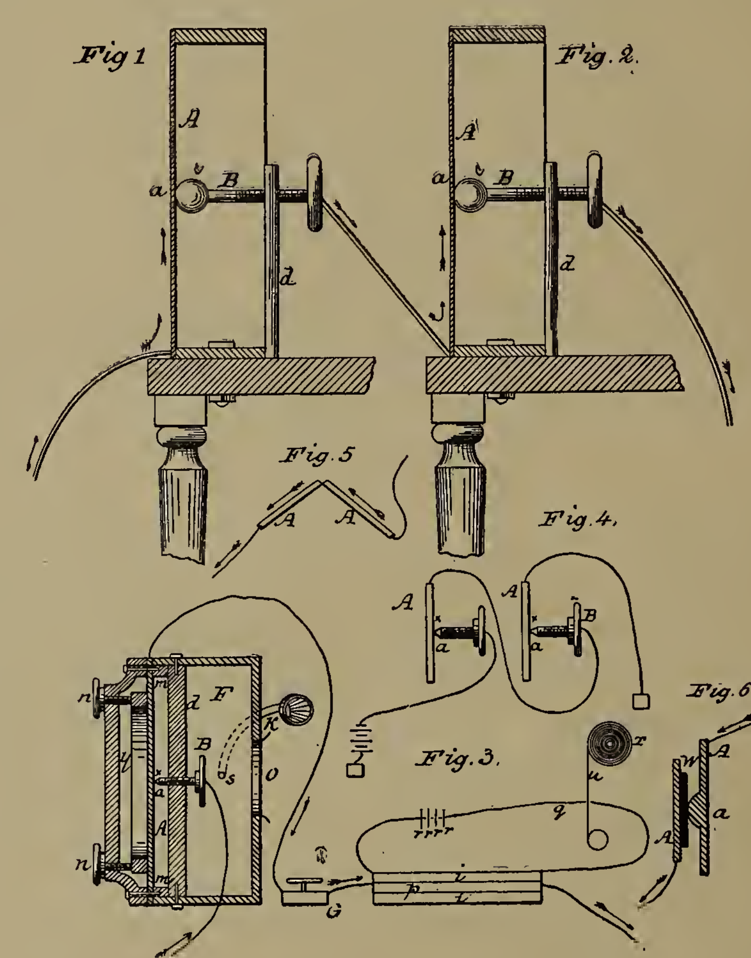
In the drawings the letter A represents a diaphragm or plate, preferably of thin metal of limited conductive capacity, such as iron, steel, German silver, platinum, and also carbon secured in the frame *m m* in the box *f* in any convenient manner.

The letter *y* represents a ring resting against one side of said diaphragm, and capable of being made to bear upon the same with more or less force by means of set-screws *n*, in order that the tension of the diaphragm may be regulated.

The letter B represents a screw or piece of metal or carbon, pointed at one end and mounted in a cross-piece, *d*, in such position that the point will be in contact with the diaphragm A. The diaphragm A is connected with one pole of a battery by means of a wire, and the pin or screw B with the other pole.

Fig. 4 shows the manner in which the complete apparatus, consisting of the transmitter A B and the receiver A B, is connected up in circuit.

It will be observed that the transmitter is of the same construction as the receiver. When a sound is uttered in



PATENT NO. 233,969.

the neighborhood of the transmitter its plate will vibrate accordingly, and the pressure between the plate and the pin or ball at the point of contact *a* will become weaker or stronger, according to the vibrations, and this variation of pressure will cause the current passing to become weaker or stronger, and thus effect the changes which operate the receiver, as already described.

As shown in Fig. 3 the box *f* is provided with a tube, K, to which the ear of the operator may be applied in order to hear the sounds produced by the vibratory diaphragm when the instrument is employed as a receiver, and a tube, O, through which he can speak when employing the instrument as a transmitter, so that the operator is not in need of moving the instrument or moving his head while carrying on a conversation. This combination, with the sound-chamber of a telephone provided with the usual sound-passage or mouth-piece of an additional sound-conveyer or hearing-tube forms, however, no part of the invention.

I claim—

1. The herein-described method of producing sound vibrations in a plate by causing a varying electric current to pass to the plate, or to an electrode connected therewith,

*See Electrical Age of December 22, 1894, for full text of decision.

from a second electrode in contact therewith, substantially as described.

2. An apparatus for producing sound by means of a varying electric current, which consists of a plate forming or carrying an electrode placed in contact with another electrode, from one to the other of which the electric current is caused to pass.

3. An electric telephone receiver to be operated by varying electric currents, and consisting of two contact-pieces within an electric circuit, one or both of which pieces consist of or are connected with a vibratory diaphragm, whereby one electric current passing through said circuit exercises a repulsion between said two electrodes corresponding to its strength, and thus produces corresponding motions in the diaphragm.

4. A system of two or more telephone instruments in electrical connection with each other, each consisting of two or more poles of an electrical circuit in contact one with the other, either or both poles of each instrument being connected with a vibratory plate, so that any vibration which is made at one contact is reproduced at the other, substantially as set forth."

Patent No. 463,569, Dated November 17, 1891.

COMBINED TELEGRAPH AND TELEPHONE.

Application filed June 4, 1877.

To all whom it may concern :

Be it known that I, Emile Berliner, of Washington, in the District of Columbia, have invented a new and useful improvement in combined telegraph and telephone, of which the following is a specification.

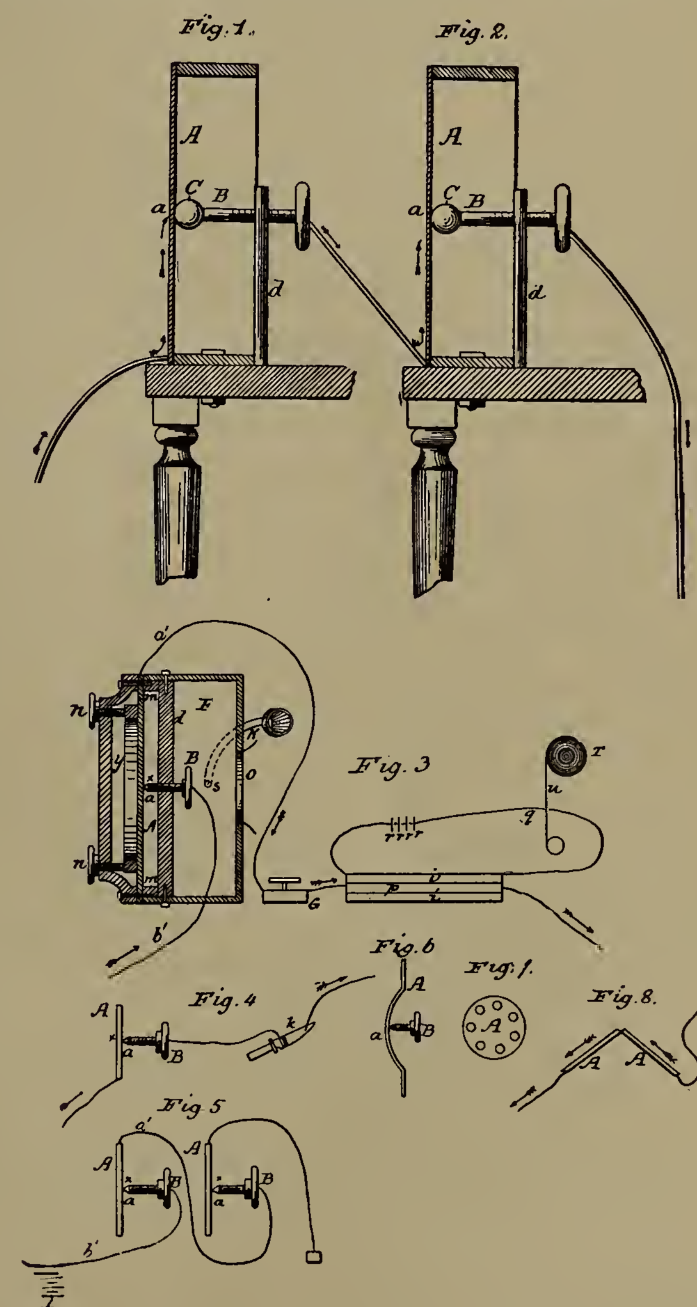
My invention consists in a new and useful improvement in transmitters for electrically transmitting sound of any kind, of which the following is a specification.

It is a fact that if at a point of contact between two conductors forming part of an electric circuit and carrying an electric current the pressure between both sides of the contact becomes weakened the current passing becomes less intense—as, for instance, if an operator on a Morse instrument does not press down the key with a certain firmness the sounder at the receiving instrument works much weaker than if the full pressure of the hand had been used. Based on this fact I have constructed a simple apparatus for transmitting sound along a line of an electric current in the following manner.

In Figures 1 and 2 of the drawings, A is a metal plate well fastened to the wooden box or frame, but able to vibrate if sound is uttered against it or in the neighborhood of said plate. Against the plate and touching it is the metal ball C, terminating the screw-threaded rod B, which is supported by the bar or stand *d*. The pressure of the ball C against the plate A can be regulated by turning the rod B The said ball and plate are included in circuit with an electric battery, so that they form electrodes, the current passing from one of them to the other. By making the plate vibrate the pressure at the point of contact *a* becomes weaker or stronger as often as vibrations occur, and the strength of the current is thereby varied accordingly, as already described. By placing now, as is shown in the drawings, one such instrument in the station, Fig. 1, and another instrument capable of acting as a telephonic receiver in the station, Fig. 2, both situated on the same electric circuit in which a current is passing (as shown by the wire connections following the arrows), sound uttered against the plate of the instrument, Fig. 1, will be reproduced by the plate of the instrument, Fig. 2, for as the vibrations of the transmitter, Fig. 1, caused by the sound will alternately weaken and strengthen the current as many times as vibrations occur, the diaphragm of the receiver will be caused by these electrical variations to vibrate at the same rate and measure. The latter vibrations being communicated to the surrounding air, the same kind of sound as uttered against the transmitter, Fig. 1, will be reproduced at the receiver, Fig. 2, or in as many other receiving instruments as are situated within the same electric circuit.

It is not essential that the plate should be of metal. It can be of any material able to vibrate, if only at the point of contact suitable arrangement is made so that the current passes through that point. The plate may be of any shape or size, or other suitable vibratory media may be used—a wire, for example. Any other metallic point, surface, wire, etc., may be substituted for the ball. There may be more than one point of contact to be affected by the same vibrations. Both of the electrodes may vibrate, although it is preferable that only one should. If the uttered sound is so strong that its vibrations will cause a breaking of the current at the point of contact in the transmitter, then the result at the receiving-instrument will be a tone much louder, but not as distinct in regard to articulation.

I have also embodied my invention in and used it in connection with some other forms of apparatus.



PATENT NO. 463,569.

In the drawings, Fig. 4 represents a detached view of the vibratory diaphragm, showing its relative situation to the poles of the galvanic current. Fig. 3 represents a view of a complete apparatus; Fig. 5, a view of the diaphragms arranged to receive and transmit the sound waves; and Figs. 6, 7 and 8, modifications of the vibratory diaphragm.

In the drawings, the letter A represents a diaphragm or plate of thin metal of limited conductive capacity, such as iron, steel, German silver, platinum, secured in the frame *m m* in the box F in any convenient manner.

The letter *y* represents a ring resting against one side of said diaphragm and capable of being made to bear upon the same with more or less force by means of set-screws *n*, in order that the tension of the diaphragm may be regulated.

The letter B represents a screw or pin of metal, pointed at one end and mounted in a cross-piece *d* in such position that the point will be in contact with the diaphragm A. The diaphragm A is connected with one pole of a bat-

tery by means of a wire a', and the pin or screw B with the other pole by means of a wire b'.

The box F of Fig. 3 is provided with a tube K, to which the ear of the operator may be applied, in order to hear the sounds produced by the vibratory diaphragm when the instrument is employed as a receiver, and a tube O, through which he can speak when employing the instrument as a transmitter, so that the operator is not in need of moving the instrument or moving his head while carrying on a conversation.

Instead of employing a single vibratory plate, as shown in Figs. 1, 2, 3, 4 and 5, in each instrument, two such plates may be employed, as illustrated in Fig. 8, said diaphragms being connected to the respective poles and in contact with each other at their edges, as shown in Fig. 8.

The diaphragm of my improved receiver or the diaphragm of any magneto-receiver (such as those described by Alexander Graham Bell in his Patent No. 174,465, of March 7, 1876, and in his Patent No. 186,787, of January 30, 1877), will receive a particularly strong shock at the setting in and sudden cessation of the current when a ticking sound will be heard from the plate; but a weakening of the current alone can also be observed most distinctly and accurately by making, for example, a connection within the same circuit by a wire and the blade of a knife *k*, Fig. 4. When scraping the wire end over the blade of the knife, this scraping is distinctly audible on the plate. Here the current is never entirely interrupted, yet the minute elevations and cavities on the blade, caused by the structure of the steel and which again cause minute alterations in the intensity of the current, are sufficient to shake or vibrate the plate with varying intensity, thus rendering again the same peculiar scraping noise. If, now, the plate of one instrument, as in Figs. 1 or 5, is vibrated by sound waves (which happens whenever any kind of sound is uttered or is produced by musical instruments in its neighborhood), every wave or vibration that strikes the plate produces between the two sides of the contact a variation of pressure, which causes a variation of resistance at that point, and therefore a variation in the strength of the passing current, and if the sound is sufficiently strong it will break the circuit at said point of contact, the variations in the current thus produced causing similar vibrations in the plate of the receiving instrument. The essential part of the apparatus is the point of contact, which must offer a resistance to the current.

It is not necessary in the transmitting apparatus that the plate should be of conducting material, for any substance capable of vibration will answer, if only at the point of contact provision is made for the current to pass. It is sometimes convenient to use a vibrating plate in the form of a reflector, as shown in Fig. 6, for concentrating the sound, or the diaphragm may be provided with a number of apertures to disperse the sound, as shown in Fig. 7. These apertures prove advantageous with strong sounds, particularly the hissing sounds, as while the sound-waves are rushing toward the diaphragm, those touching the plate are repelled and partially destroy the following waves, just as sea waves when forced against a cliff will be thrown back, destroying those directly behind. The holes permit most of the waves to pass to the other side of the plate, making the vibration of the plate more perfect and even.

I will here describe a recording apparatus, which, however, I do not claim.

In Fig. 3, G is a galvanometer, which is located in circuit with the contact-pieces or electrodes A B, and which serves as a convenient means for ascertaining the adjustment of the contact-pieces of the transmitter, so that a current shall pass. *i p i* is a Ruhmkorff coil or induction apparatus. When a current passes through the primary coil *p* and suddenly is broken, a spark will rush over between the ends of the secondary coil *i i* at *q*. This spark is accompanied by a peculiar sound due to the electric discharge, and if we bring between the ends of the secondary the connecting points *r*, *r*, *r*, *r*, a spark will occur between each of them, provided they are near enough to each other, and the peculiar sound will be heard between each of them. I now arrange a strip of chemically-prepared paper or other substance *n* to be drawn by clockwork T between the ends of this secondary wire at *q*. Said strip can be prepared in such a way that each spark will produce a mark upon it. If, therefore, the plate A vibrates by sound, each vibration causing a break of contact will produce a spark at *q*, and the strip being drawn through, a succession of marks will be produced upon the strip according to the number of vibrations caused by the sound; but at the same time the sound which was uttered at the plate A will be heard from the sparks rushing over the points *r*, *r*, *r*, *r*, and *q*, because every spark produces one wave in the atmosphere in which it occurs, and a certain number of waves will therefore produce certain tones. Therefore, the same sound which is uttered against the plate A will be heard from the sparks. The scraping of the wire end on the knife-blade *k*, as in Fig. 4, in the primary current will also be heard between the wire ends of the secondary current at *r*, *r*, *r*, *r*, and *q*. This permits a number of designs for a receiving apparatus within the secondary current. For instance, initials, ornaments, etc., consisting of a number of metal pins can be constructed in such a way that whenever a tone is produced against the plate A a spark will rush over said metal pins, and at the same time their sound is produced will render the design visible in illuminated characters.

By making the person of the operator a part of the secondary circuit and discharging the sparks in the body in the neighborhood of the ear the sound will be more particularly apparent.

It will be observed that in Figs. 1 and 2 one of the electrodes presents a convex curvilinear surface like a rounded knob. This possesses some advantages, among which are ease of construction and durability, because it does not wear away the opposing electrode as much as a sharp one would, and when the contact with the vibrating body is made of such a form the freedom of the vibration is less interfered with.

I do not claim that I am the first inventor of the art of transmitting vocal and other sounds telegraphically by causing electrical undulations similar in form to the sound waves accompanying said sounds. Neither do I claim that I am the first who caused such electrical undulations by varying the resistance of an electric circuit in which a current was passing.

I do not herein claim the novel form of vibratory-plate receiver which I have described, because that is a subject of claim in another application.

I claim—

1. The method of producing in a circuit electrical undulations similar in form to sound waves by causing the sound waves to vary the pressure between electrodes in constant contact so as to strengthen and weaken the contact and thereby increase and diminish the resistance of the circuit, substantially as described.

2. An electric speaking-telephone transmitter operated by sound waves and consisting of a plate sensitive to said sound waves, electrodes in constant contact with each other and forming part of a circuit which includes a battery or other source of electric energy and adapted to increase and decrease the resistance of the electric circuit by the variation in pressure between them caused by the vibrational movement of said sensitive plate.

3. The combination, with the diaphragm and vibratory electrode, of a rigidly-held opposing electrode in constant contact with the vibratory electrode, substantially as described.

4. In a telephonic transmitter, a vibrational plate made concave for condensing the sound, substantially as set forth.

5. In a telephonic transmitter, a vibrational plate provided with one or more apertures, as and for the purposes set forth.

6. A speaking-telephone transmitter comprising a diaphragm or disk sensitive to sound waves, combined with a rigidly-held but adjustable electrode in contact with the same, whereby the electric current is transformed into a

series of undulations corresponding with the vibrations of said diaphragm.

The two patents are signed by Emile Berliner in the presence of witnesses in the usual form.

THE MIANUS ELECTRIC COMPANY.

Mianus, Conn., is quite an electrical manufacturing centre. It is only 30 miles distant from New York city, and 50 minutes in time. Among the electrical concerns in the place is the Mianus Electrical Co., manufacturers of interior and exterior loud-speaking telephones.

This company manufactures a large line of telephones and parts. Among them may be mentioned the Compact Telephone, for main line and general use, the No. 10 Telephone, for exchange work, private line and factory purposes; Main line No. 11 Telephone; Battery Call Telephone with Blake Transmitter; Main line Blake Telephone; Main line Blake without Battery Box; Long Distance Transmitters; Blake Transmitters; Telephones with Magneto Transmitters; Magneto Bells; Extension Bells; Induction Coils, Switchboards, etc., etc.

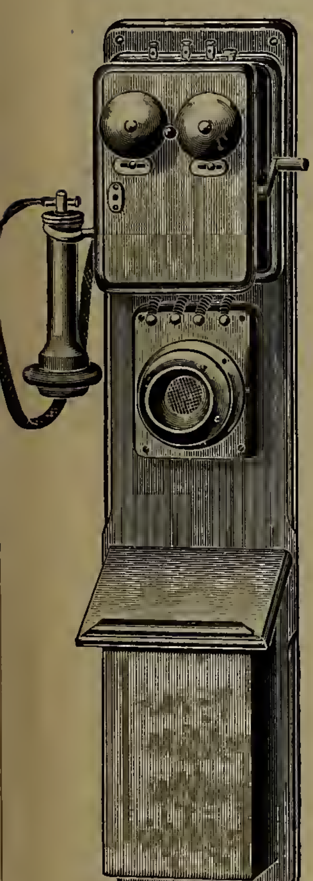


FIG. 3—BLAKE TELEPHONE.

FIG. 2—LONG-DISTANCE TRANSMITTER.

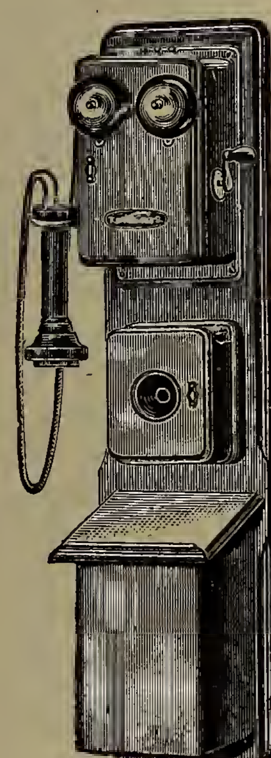


FIG. 1—MAIN LINE TELEPHONE.

The "Compact" telephone is very compact in form. It has a 10,000-ohm bell, switch receiver and long distance transmitter, an illustration of which is given in Fig. 2. The battery can be placed at any convenient point and wired to the bell box.

The main line telephone (Fig. 1) is provided with a standard receiver and bell and long-distance transmitter, shown in Fig. 2. These instruments are finished in the best manner possible in black walnut.

The Battery Call Telephone with Blake Transmitter is a very convenient arrangement for factory or storehouse use. It can be used as well as a general telephone. It is well made and easily installed.

Fig. 3 shows the Main Line Blake Telephone, with standard magneto Blake transmitter, receiver, etc. The same outfit is provided, when desired, without battery box; in this case the battery may be placed at any convenient point away from the instrument and wired up in the usual manner.

The Mianus Company considers its long distance transmitter (Fig. 2) the peer of battery transmitters. It is said to be better than the Blake, as it requires no adjustment, the original adjustment lasting for all time. It transmits speech in a very clear manner, and it is not necessary to talk above the ordinary tone. The company has sold many of these transmitters to exchanges to displace magneto transmitters. This instrument is made on two principles, one is the granulated carbon Hunnings, and in the other carbon balls are used. The Hunnings transmitter

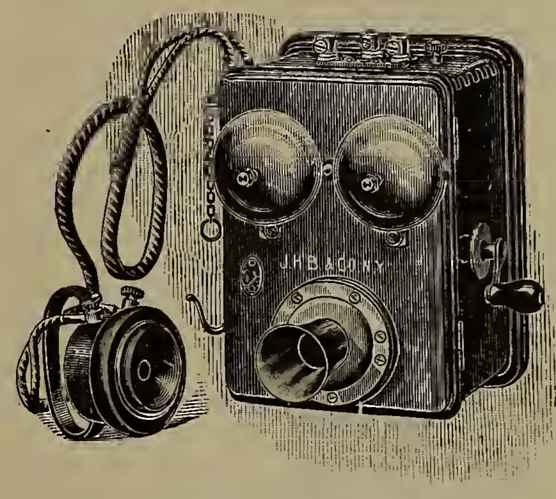


FIG 1—BUNNELL'S MAGNETO TELEPHONE OUTFIT.

FIG. 3—TRANSMITTER MOUTHPIECE.

is well known as the instrument used by the English Post-office for long-distance service.

The telephone with magneto receiver made by this company is intended for short lines, such as from house to barn, house to office, etc., and is a very serviceable instrument. The bell, receiver, transmitter and push-button are all on one backboard.

The switchboards are made to order with any number of drops desired. The Palmer patent lever drop is used in their construction and gives excellent satisfaction in practical operation.

The other pieces of apparatus referred to are so familiar to every one, that a description of them here would be superfluous. Suffice it to say, that all of the instruments made by this company are constructed in the very best manner possible with the best materials available. The company has a reputation for its careful and first-class work and is enjoying a very large trade.

In this connection it would be of interest to refer to the Premier Pencil Transmitter made by this company. It is a fine talking instrument and is made of special telephone carbon pencils. It is equally serviceable on either long or short lines. The Premier transmitter is supplied independently or with other parts of a telephone outfit as desired. It has considerable merit.

J. H. BUNNELL & CO.

The old supply house of J. H. Bunnell & Co., 76 Cortlandt street, New York, manufactures a practical non-infringing electric telephone which is one of the most serviceable instruments in use. The Bunnell telephones

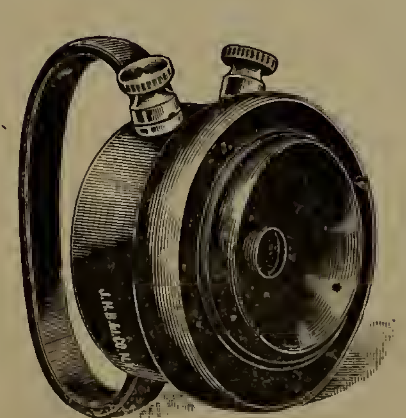


FIG. 2—BUNNELL MAGNETO TELEPHONE.

FIG. 4—BELL TELEPHONE.

are simple in construction and require no battery for their operation. They are always in adjustment, thus avoiding the annoyances incident to the use of an instrument that requires readjustment. These telephones give good satisfaction on lines of any length up to ten or fifteen miles.

Fig. 1 shows the standard Magneto Telephone outfit. This instrument is made with two grades of magneto calls —the Pony Magneto call and the Standard Magneto call.

The Pony magneto will ring on lines up to three miles in length, while the Standard magneto is recommended for lines of greater length.

This firm makes a neat nickel-plated mouthpiece to fit their telephones when used as transmitters. This adjunct is shown in Fig. 3. It adds to the effectiveness of the transmitter by causing the voice to impinge with greater certainty and force upon the centre of the diaphragm. It is easily and quickly applied.

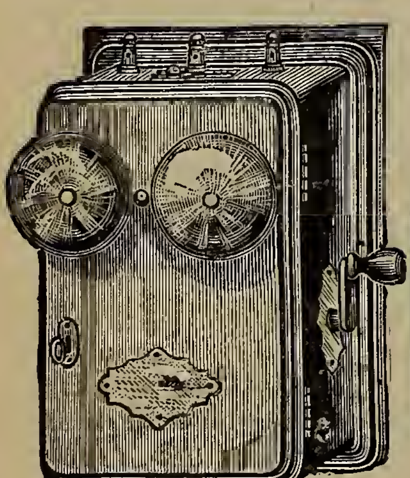
J. H. Bunnell & Co. are headquarters for telephone supplies of all kinds, and they furnish non-infringing switchboards of any capacity. They also handle the Bell form of magneto transmitter, as shown in Fig. 4.

The telephone outfit above described and illustrated, it will be seen, is very compact, as well as efficient, and it is made in the best manner possible. They are guaranteed by the firm to be first-class, and it is needless to say that such a guarantee from this house is worth something.

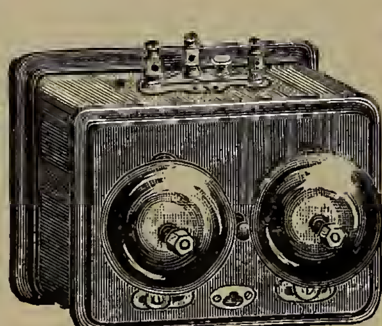
PALMER BROS., MIANUS, CONN.

In the manufacture of magneto bells, telephone receivers, extension bells, backboards, battery boxes, and general telephone supplies, Messrs. Palmer Bros., Mianus, Conn., are entitled to a place in the front ranks.

This well-known concern is fortunate in having so convenient a location for their factory. Mianus is only 30 miles from New York City, and is on the New York, New Haven & Hartford Railroad, the great four-track line between New York and Boston. The distance in time



MAGNETO BELL.



EXTENSION BELL.

RECEIVER.

from New York is only 50 minutes thus it will be seen that the firm is as accessibly located with reference to the metropolis as are many industries in the upper sections of the city itself. By being out of the city Palmer Bros. enjoy the advantage of having no city rents to pay, consequently they are able to give dealers the benefit of the low prices at which they are able to produce their excellent goods

The firm employs skilled labor and first-class material in the manufacture of its instruments, and its reputation as a first-class house is well known.

In addition to the advantages above named they enjoy that of a water-power plant which they themselves own. This also greatly aids in keeping their expenses down to a minimum.

As manufacturers of Bell telephone receivers Palmer Bros. are among the largest in the country, outside of the Bell Company itself. They also manufacture on a large scale telephone induction coils, and enjoy a large trade in these goods. Several of the new telephone manufacturing companies purchase their receivers, bells and coils of this firm.

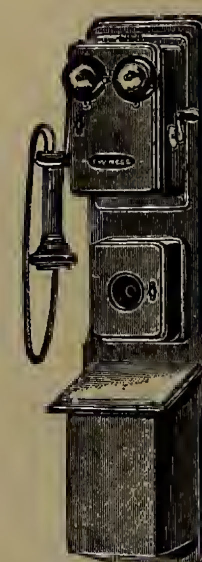
Palmer Bros. do not confine themselves to the manufacture of telephone apparatus alone. They make small motors and dynamos, which are well known in the trade for their efficiency, and Wimshurst electric machines. They are also large dealers in general electrical supplies.

The accompanying illustrations show the receiver, extension bell and magneto bell made by this firm.

T. W. NESS & CO., MONTREAL.

Canada, as is well-known, has been a free country for telephones for some time, the Canadian courts having several years ago annulled the Bell patents. It is there-

NESS' WAREHOUSE TELEPHONE.



NESS' STANDARD TELEPHONE.

fore interesting to learn what systems and instruments have been adopted there by companies in competition with the Bell Telephone Co.

In this connection we will describe some of the instruments manufactured by T. W. Ness & Co., 749 Craig street, Montreal, who enjoy an enviable reputation in the telephone field.

The standard instrument manufactured by this firm is very similar to that used by the Bell Company. It consists of a magneto bell with special long lever hook, of their own designing; Blake transmitter and battery-box all mounted on a backboard, as shown in the illustration. They make up several other combinations to suit the requirements of the trade. One of these which meets with special favor is their No. 3 B. This instrument consists of a Standard magneto and Blake transmitter combined in one box, the battery may be placed anywhere near the instrument. This makes a very compact and desirable 'phone for private lines.

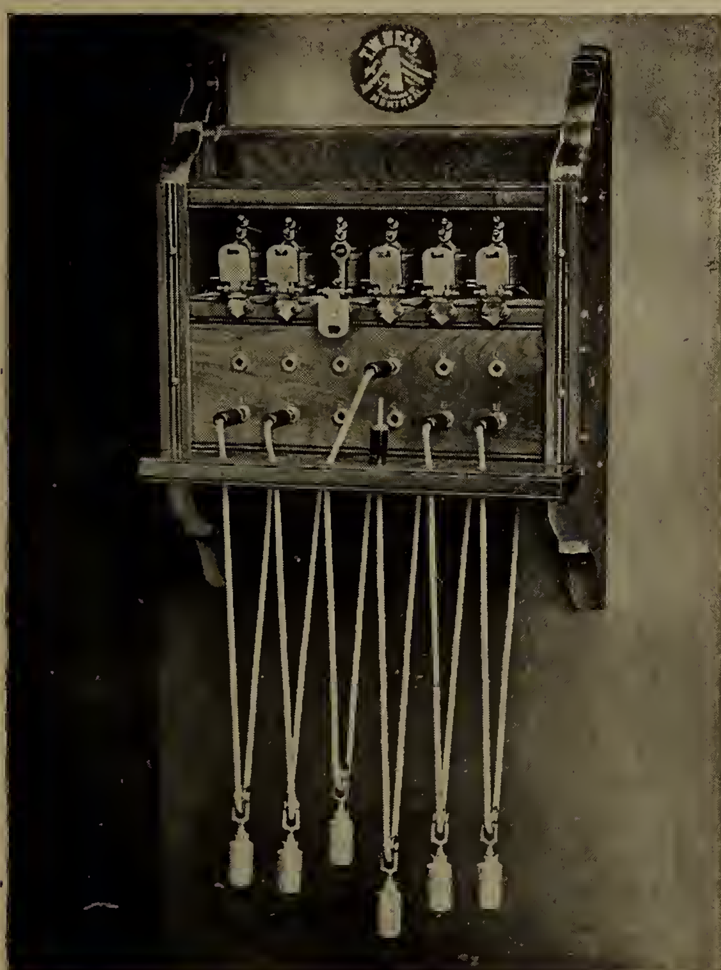
Although the Blake transmitter seems to be the favorite for general work, this company turns out a number of different styles of transmitters which give most sastisfactory results. One of these is a multiple contact transmitter, consisting of a number of small carbon balls about the size of a pea, held in loose contact between a carbon diaphragm and a carbon block indented so as to hold the balls in place; it is obvious that as each ball varies its contact with the diaphragm, the total variation of current flowing through the primary of induction coil will be equal to the variation of one ball by seven (there being seven balls). This instrument never requires adjusting after leaving the factory.

A dust transmitter is conceded by all to be the best for long distance telephoning, and to meet this class of work the company furnishes the celebrated Mildé transmitter imported from France, the sole agency of which the company has had for some time. This transmitter is used extensively on the other side and is meeting with great favor both in Canada and the United States. It is moisture-proof and so arranged that the particles cannot pack.

Messrs. Ness & Co. also manufacture and supply all the necessary accessories for installing and maintaining complete telephone systems, such as exchange switchboards, extension bells, toll jacks, lightning arresters, etc.

Their exchange switchboard is usually made in cabinet style, finished in natural cherry; another form of wall switchboard is herewith illustrated. The drops used are of the double magnet type, very sensitive and having fine adjustment. In this system of exchange there is a plug for each subscriber, so that only one plug requires to be inserted in making a connection.

Ness & Co. have an excellent system for communication between different departments of warehouses, factories, etc. Each instrument is provided with a special switch, so that instant communication can be had between any two instruments in a series, while two or more sets of parties can converse at the same time without interfering



NESS' SWITCHBOARD—WALL PATTERN.

with one another. An automatic switch, invented and patented by Mr. Ness, returns to its normal position when the receiver is replaced upon the hook.

THE GILLILAND TELEPHONE CO.

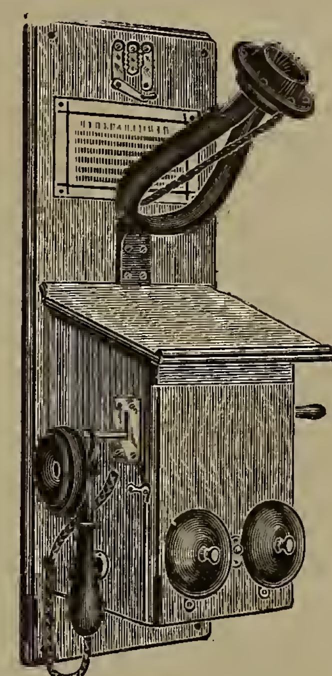
The Gilliland Telephone Company, 186 and 188 Fifth avenue, Chicago, manufactures telephones, switchboards and switching apparatus.

The accompanying illustration shows the company's standard wall set. The magneto 'phone is a superior instrument on account of the length of its magnetic circuit. It is said to be an excellent "talker." These telephones have been adopted by many prominent railroads and are in use on lines 30 miles long. In some instances they are used in transmitting train orders, a service which, as all know, requires the utmost care and certainty. This use of the Gilliland instrument speaks well for its efficiency.

In addition to the wall set above referred to, the company manufactures pedestals of plain and ornamental design for desk use, accomplishing the same service as the standard wall set. Switches for all systems of intercommunication, switchboards of any desired capacity adapted to ground, common return or metallic circuit systems are also named among this company's products. These instruments are finished in several styles.

The company's exchange switchboard is manufactured in 50-wire sections and occupies a space 14 inches wide. The small switchboards can be placed on office desks or fastened to the wall.

A telephone exchange of over 100 subscribers equipped



GILLILAND TELEPHONE OUTFIT.

throughout with Gilliland telephones and switchboard, after having been in operation some months, has been pronounced more satisfactory as regards service and construction than the old service.

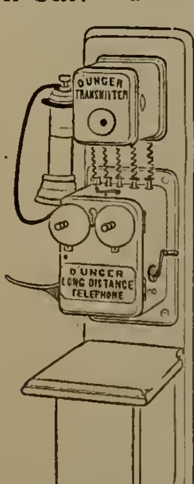
The company has a large manufacturing plant in Adrian, Mich. Mr. William H. McKinlock is the president and J. J. Nate general manager.

THE D'UNGER LONG-DISTANCE TELEPHONE.

The D'Unger Long-Distance Telephone is an electrical telephone complete in itself, is made under patents granted to Dr. D'Unger on October 2, 1888, and August 27, 1889, and to Paul H. D'Unger on June 12, 1892. They are claimed to be not only the most powerful as to sending speech long distances, but likewise the only ones that will send speech in distinct and clear tones.

Mechanically, they are constructed in a superior manner, and they are extremely simple. They possess a quality that no other telephone possesses; that is, they have the power of cleaning themselves. Every vibration made by the voice cleans the carbons, for this instrument is an all-carbon contact one, hence, neither the action of the atmosphere, nor the electricity affects it.

The transmitter consists of four square carbon pencils, swinging from a metal rod, the pencils resting on a small carbon bar. This bar is fixed in a yoke forming one end



D'UNGER TELEPHONE.

D'UNGER TRANSMITTER.

of a lever, the other end of this lever being fastened to the centre of the diaphragm or voice plate. The carbon bar in the yoke is four times nearer the fulcrum than is the end of the lever which is fastened to the voice plate. The

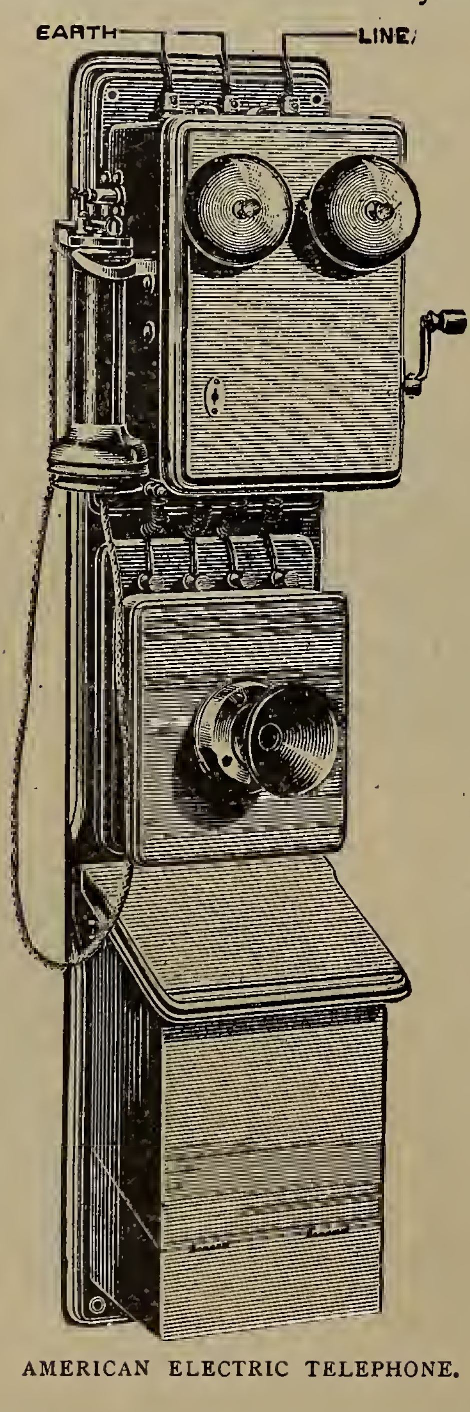
benefit of the leverage is thus readily seen, the pressure of the bar against the pencils being nearly four times greater than is the pressure made by the voice on the plate, the power of the electrical current is thus greatly augmented. It is this arrangement that makes a long distance telephone.

The receiver is a compound magnet. It consists of three pieces; the outer ones being of hardened steel and the inner one of soft steel or soft iron—this soft iron central piece is longer than the others and its end is drawn out to a size and form sufficient to extend from the back end of the bar forward to the case through the front again, where it is flattened to form the diaphragm. This return piece is corrugated near the flattened end so as to permit the adjustment of the diaphragm and magnet with reference to each other, without straining any of its parts. To the back end of the bar is secured a button of brass or other suitable material, to receive the screw by which the adjustment is effected. By this construction the diaphragm forms one pole of the magnet, the other pole being the end of the bar adjacent to the diaphragm.

The D'Unger instruments work equally as well on short lines as on long ones, and require no repairs. They are manufactured and sold outright by the D'Unger Electrical Telephone Manufacturing Co., 167 Dearborn street, Chicago, Ill.

THE AMERICAN ELECTRIC TELEPHONE COMPANY.

The "Hunnings" English dust transmitter is acknowledged to be one of the best transmitters yet invented, and



AMERICAN ELECTRIC TELEPHONE.

the principle is embodied in the instrument used by the Long Distance Telephone Company in the United States. The "Hunnings" long distance instrument is the original powder transmitter patented in England and America, and is the only one adopted by the English post-office for public long distance service. A shout or a whisper gives perfect articulation at the receiver, and there is no limit to the distance over which it will work.

For its operation the "Hunnings" transmitter does not depend upon variable pressure between electrodes in constant contact, but, instead, a quantity of finely divided conducting material or dust is incorporated as a portion of the electric circuit. The movement of this "dust" causes the variation of the current.

This company claims to be the only manufacturers in the United States of the "Hunnings" English dust transmitter. It has installed exchanges in Chicago and all parts of the United States, and its instruments enjoy an excellent reputation.

The American Company manufactures "Hunnings" transmitters of various designs for different purposes, also complete telephone outfits of different designs. These include the regular wall outfit and the desk set, the latter in very compact and convenient form. The loud speaking combination set is designed for loudly reproducing speeches, music, sermons, etc., the transmitter being provided with a funnel-shaped extension for the collection and concentration of the sound waves.

Another special piece of apparatus is the combined transmitter and receiver.

The American Electric Telephone Company is a dealer in general telephone supplies and enjoys a large trade.

THE WESTERN TELEPHONE CONSTRUCTION CO.

Among the telephone manufacturing concerns, none is more widely and better known than the Western Telephone Construction Company, of Chicago.

This company owns or controls some of the most valuable patents in the telephone business and its instruments are in use in every country in the Union. It has a very large business, extending even to South America and other foreign countries.

The Western Telephone Construction Company's dynamic telephone is made under several patents owned or

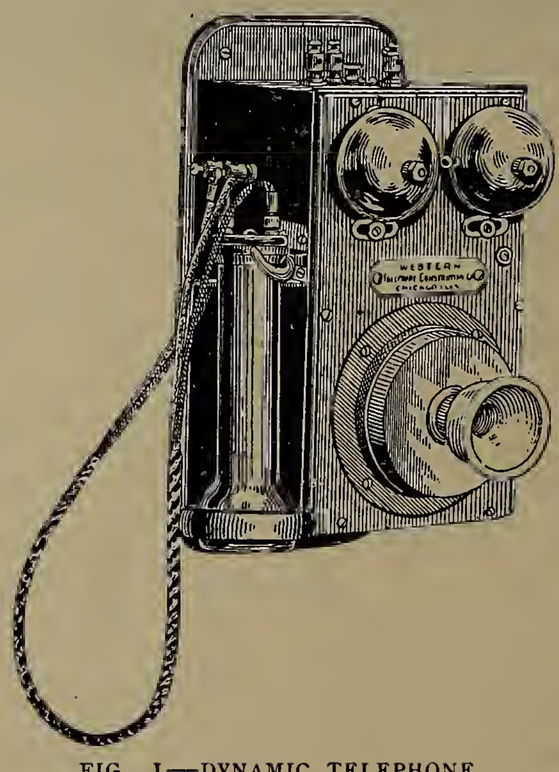


FIG. 1—DYNAMIC TELEPHONE.

controlled by it. These instruments are claimed to be superior to any magneto telephone yet offered to the public. The principle involved in their construction is entirely new, and they are equally good for use on long or short distance lines. This instrument was successfuly used for talking between New York and Chicago, and a number of experts present on this occasion proclaimed it to be superior for the purpose to the Bell long distance instrument.

Its uniform satisfaction in nearly 50 telephone exchanges scattered throughout the United States is the best testimonial that can be given. Its economy of operation, it is said, has been proven to be the greatest of any telephone in existence. In a great many cases telephone exchange reports called for by this company have shown that it costs less than 50 cents per telephone per month, and this is considered the greatest showing that can be made by any telephone exchange in existence, large or small, giving public service.

The dynamic telephone requires no batteries, no primary or secondary induction coils, no carbon contacts, etc., to get out of order and cause annoyance. With ordinary care and use it is good for a lifetime. The company guarantees it against patent infringement. The instrument is made in a first-class manner. Fig. 1 gives an illustration of a dynamic telephone. It is very compact in form.

This compony also makes a special telephone, practically in the same form as the commercial telephone used by the Bell Company. In its construction, however, care

FIG. 2—WESTERN TELEPHONE CONSTRUCTION CO.'S SWITCHBOARD.

has been taken to avoid patent difficulties and the company guarantees it against infringement.

The Western Company manufactures several styles of desk telephones, and makes specially designed instruments on order.

The switchboards manufactured by this company are entirely non-infringing, several thousand dollars having been spent in obtaining patents and perfecting switching devices The company makes five different types of switchboards. The one shown in our illustration, Fig. 2, is the standard 100 subscriber board. It is claimed to be the most compact, durable and economically operated switchboard in existence. The 100-connection board requires a space of but 10 inches by 15 inches by 4 inches, and can be placed in the waste space of a writing-desk. The same movement by the operator which places the plug in the jack, restores the drop. This board is equipped for both metallic circuit or single line systems, and can be added to by sections without limit. It is claimed to be superior in electrical design, economy, simplicity of construction, and for adaptability for large and small exchanges, to any switchboard yet produced. Western telephones are used in public telephone exchanges very

FIG. 1.

extensively, and a large number of private concerns also use them.

The offices of the company are at 539 Monadnock block, Chicago. Mr. James E. Keelyn is president and Mr. I. Baumgartl is general manager.

WEBER & BRO., PHILADELPHIA, PA.

This company manufactures a speaking attachment for

FIG. 2.

telephones, the object of which is to render sound more distinct and give greater satisfaction in using the instrument. With the use of this attachment conversation can

be carried on with greater ease and comfort and with greater secrecy. This invention, which is patented, consists essentially of an extension speaking tube in connection with the transmitter of the telephone, to which is attached a metal rod supporting the receiver. Its use is seen in Fig. 1, where the person is sitting at the desk carrying on a conversation over the line.

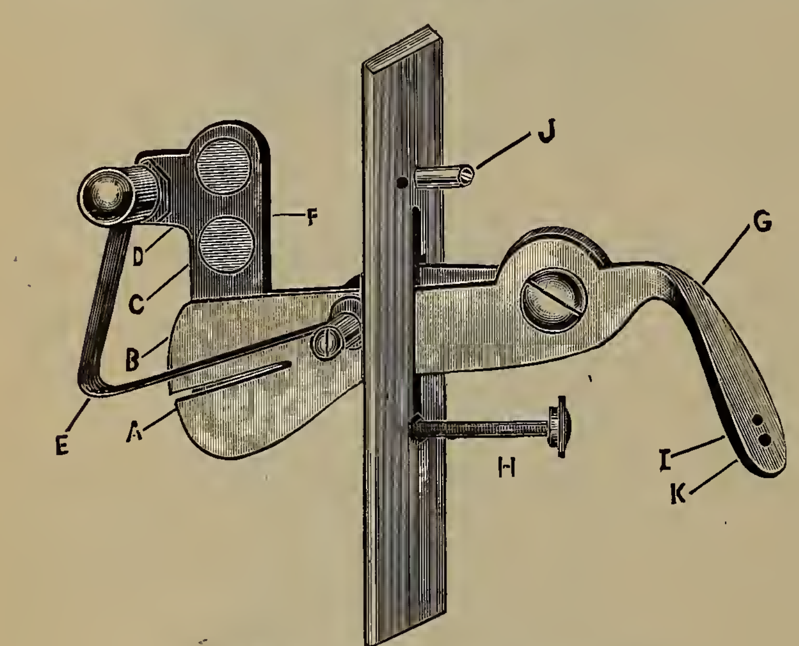
The object of this arrangement is that it does away with the necessity of standing up to the telephone. The person may sit at his desk and converse as easily, and a short person may use the instrument as well as a tall one, as is shown in Fig. 2.

The position assumed in using the telephone with this attachment is always an easy one, and it is not necessary to stand on tip-toe or strain one's self in any way whatever to reach the transmitter.

Weber & Bro., 2209 and 2211 N. Front street, Philadelphia, Pa., are the manufacturers of this handy device.

TELEPHONE SWITCH DEVICE.

The switch device illustrated herewith is compact and applicable to any magneto call-bell or transmitter in a few minutes. It can be used for operating magneto or battery telephones and with any form of instrument, regardless of weight. It can also be arranged to operate as a plain telephone support and switch and as a positively compulsory



TELEPHONE SWITCH DEVICE.

device that is rendering it impossible to remove, secure or support the telephone without first doing the necessary switching. Thus the telephone is securely locked when not in use. The device is named the Universal Telephone Switch—a well-chosen name when all of the possible uses of the instrument are considered. It is suitable at all times for all conditions, and is destined to become very popular.

This convenient device is manufactured by E. C. Bradley & Co., 7–13 Stone street, Rochester, N. Y.

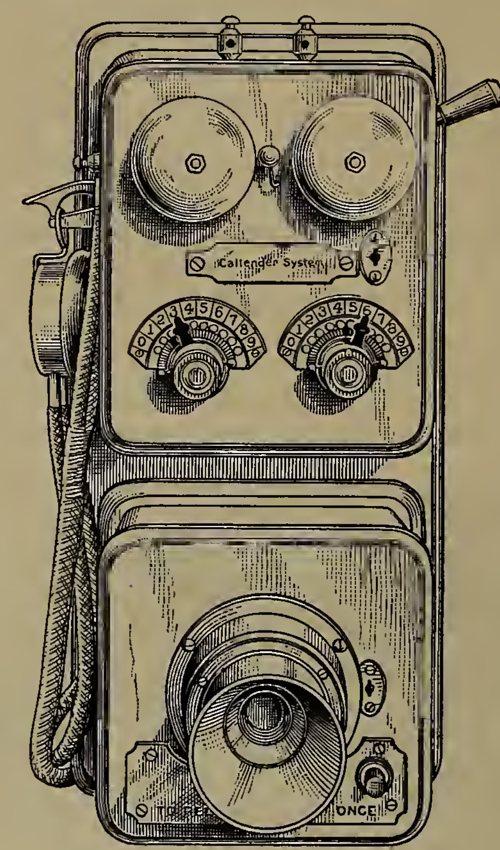
A NEW TELEPHONE EXCHANGE SYSTEM.

There will shortly be submitted to the public an entirely new system of telephone exchange.

Several years have been spent by the inventor in perfecting his system, which is protected by over a dozen patents.

He has dispensed entirely with operators and discards the expensive switchboard with its numerous connections. Subscribers make their own connections automatically by the use of a simple device attached to each telephone.

This invention marks the introduction of a practical automatic exchange system, as it dispenses with extra wires and multiple connections and does not require an individual apparatus at the exchange for each subscriber. By a simple arrangement the connecting mechanism at the exchange is common to all of the subscribers, and ninety per cent. of the installation expense is saved by only providing sufficient apparatus to meet the maximum demands of the subscribers at one time ; it being a well-known fact that only a percentage of the total number of telephones is ever in use simultaneously.

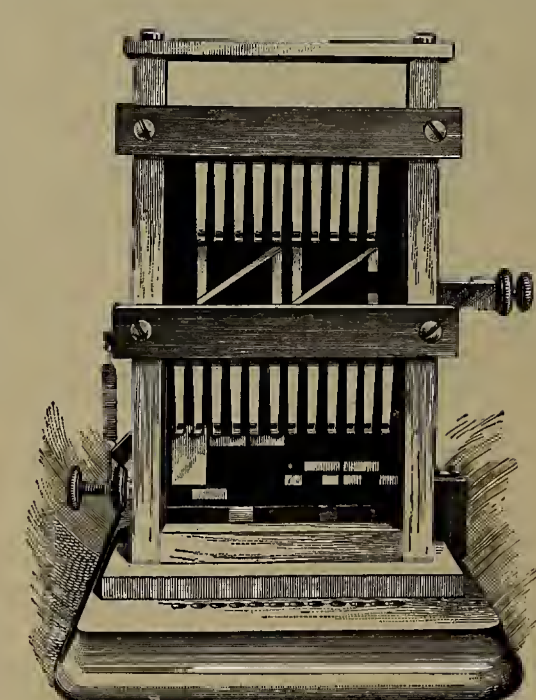


SIGNALING TRANSMITTER.

The new system provides means for registering the number of connections had by each subscriber, so that, where desired, payment for actual use may be arranged for on an equitable basis. It takes only twelve seconds to establish a connection, no matter how high the number called.

These improvements make the construction and maintenance of an exchange so much less expensive than existing systems that telephones can be supplied to subscribers at from thirty to sixty per cent. less than present rates ; the exact saving depending upon local conditions.

This system is the invention of Romaine Callender, and

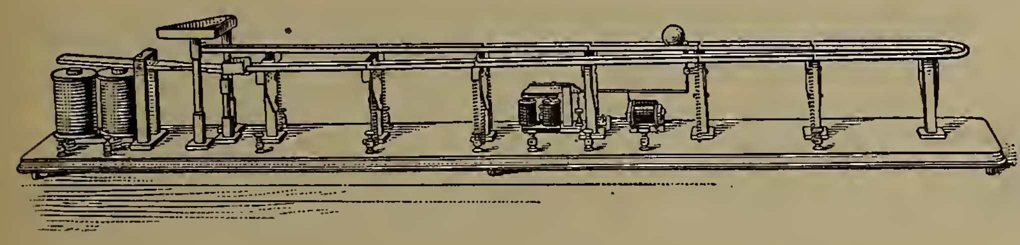


PROGRESSIVE SWITCH—2D VIEW.

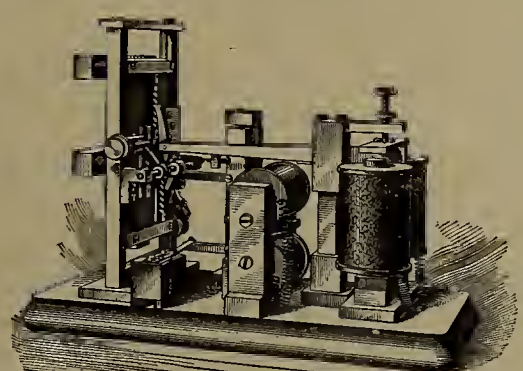
the public exhibition will take place at his laboratory in the Decker Building, Union Square, New York, on and after January 23.

The apparatus at the subscriber's station consists of a transmitter, receiver, battery and call-bell, together with a signaling transmitter of special form. This latter instrument transmits electrical impulses in series or sets to the

exchange station. The circuit making-and-breaking cylinder is connected electrically with a series of hand-operated indicator switches, located in the front of the signaling transmitter case. Each of these switches indicates any number from 0 to 9. The mechanism of the signaling transmitter includes a controlling commutator for changing the circuit through the several indicator switches in succession, and the impulses as they arrive at the exchange are automatically classified into hundreds, tens, etc., and registered on one or more instruments called "Numerical Receivers." In series with each group of numerical receivers is a "Numerical Separator," which distributes the different sets of impulses to their respective receivers. An instrument called the "Numeralizer" now comes into play, and totalizes the indications of hundreds, tens, etc., and then selects the circuit of equivalent numerical value. The signaling telephone is then connected to the telephone signaled for, and at the same time a copper ball, which has been released over a signaling track, runs along it by gravity and causes the call-bells of both subscribers to be operated, notifying them of their interconnection.

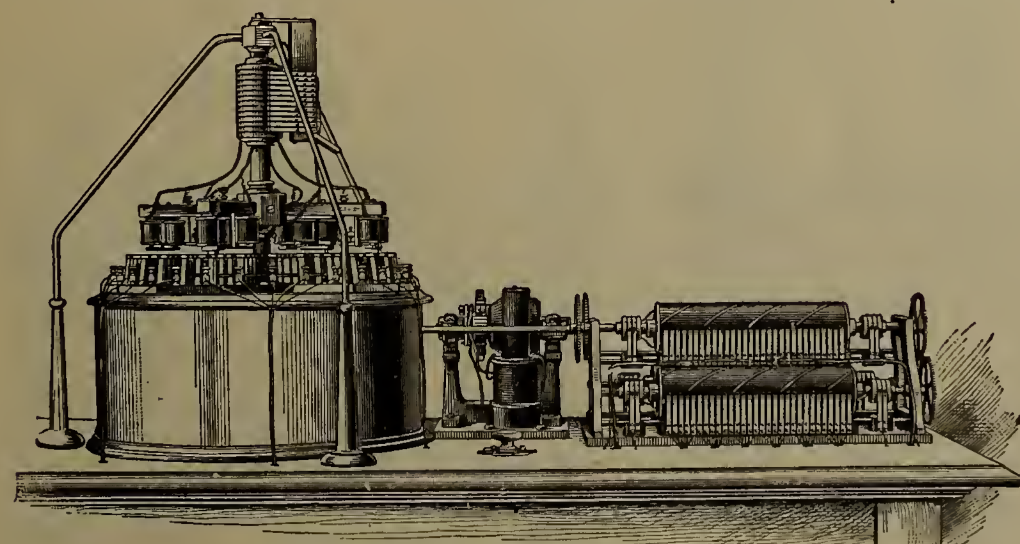


SIGNALING TRACK.



PROGRESSIVE SWITCH.—1ST VIEW.

At the central station is located the "circuit selector," which controls the "progressive switch." The latter instrument isolates the signaling line and prevents interference with the line until the switch again passes from under its control. The "progressive switch" is restored to its normal condition by the signaling subscriber releasing it, or by a time limit apparatus at the central station, if such apparatus is used.



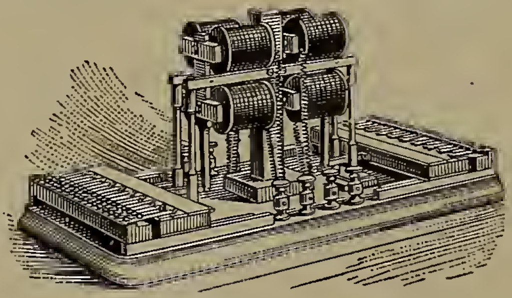
CIRCUIT SELECTOR.

The progressive switches work in pairs, the second instrument individualizing itself to the use of the telephone signaled for, and puts the switch in condition for sending a call signal over the line to the subscriber called.

The circuits are so arranged that when a call arrives at the exchange for a connection with a telephone already connected and in use, no progressive switch can be individualized to the use of the busy line until it goes into disuse.

THE ACME TELEPHONE.

The Acme telephone is one of the simplest instruments of its class ever put before the trade. It is made by Mr. O. Moran, of 34 Broadway, New York city, and has some noteworthy features.



NUMERALIZER.

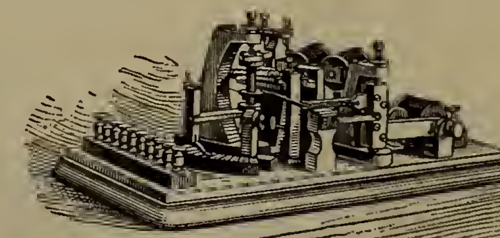
The receiver is made of insulating material, about 2½ inches in diameter and 2 inches high, and is drum-shaped.

The mouth-piece is attached to the circumference of the drum, and the diaphragm (which is of thin insulating material) is set diagonally across the interior of the case. Resting on the diaphragm are two carbon pencils, on top of which are set loosely several other pencils. Contact is effected by the weight of the pencils. The electrical connections are made by the two lower carbons.

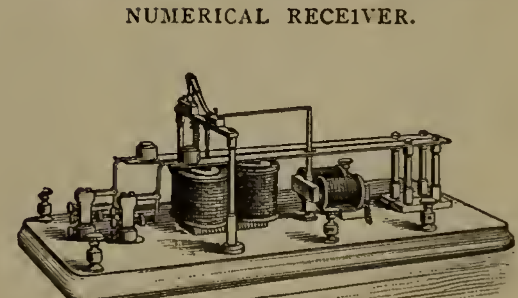
A representative of The Electrical Age conversed over one of these 'phones and was surprised at the clearness of the voice. The instrument is so simple that it cannot get out of order; there are no springs or other regulating devices to complicate its action.

Mr. Moran makes two styles of instruments, an illustration of each of which accompanies this article. The portable telephone provides any desired number of connections for interior service, such as in office buildings, factories, etc. The regular telephone set, as shown, is a very complete instrument. By use of the arm support the transmitter can be raised or lowered to any convenient height.

To the end of the receiver is rigidly attached a metal plug which is inserted in the side of the magneto. By inserting the plug the contacts are separated and the magneto cut into circuit, ready for a call. When the receiver is removed the contact points are closed and the magneto is cut out of circuit and the talking circuit cut in.



NUMERICAL RECEIVER.



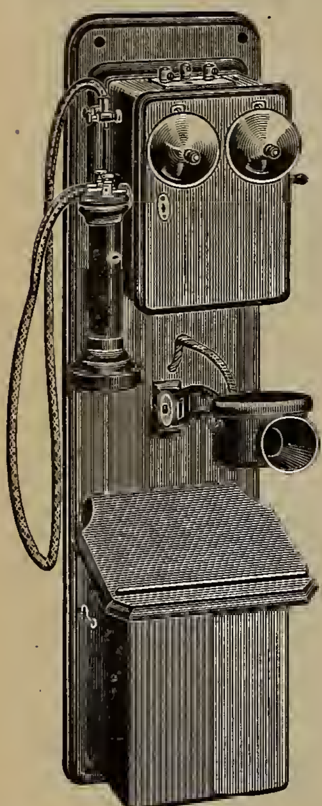
NUMERICAL SEPARATOR.

Eighty of these sets have been in use in an exchange in Somerville, N. J., for the past year. These instruments are also used in the University of New York, and by Vanderhof & Co., and Dr. Loomis, of New York city. All these parties are well pleased with the service. These 'phones are giving the utmost satisfaction.

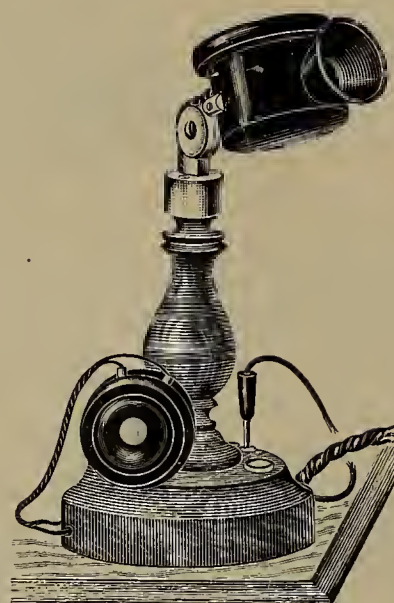
GODFREY, HARRINGTON & OLSEN'S RECEPTION.

We give herewith a picture that tells its own story. It represents the scene that was witnessed by hundreds of electrical people on the afternoon of December 31, last.

It is hardly necessary to say that the theatre of action is the offices of Messrs. Godfrey, Harrington & Olsen. It will be remembered that on the date mentioned these gentlemen



ACME TELEPHONE.



ACME DESK TELEPHONE.

inaugurated their new venture by giving a reception to the electrical fraternity, and that that reception was a complete success. It was largely attended, and the new combination received the heartiest good wishes of all present for their success. An account of the event was published in our issue of January 5.

RECEPTION OF GODFREY, HARRINGTON AND OLSEN AT THEIR NEW OFFICES.

The firm's offices now constitute the headquarters for Habirshaw wires and cables of all kinds and for all purposes, and are conveniently located with reference to the electrical trade in this city. The offices are at 15 Cortlandt street, Room 52.

James W. Godfrey, F. W. Harrington and J. B. Olsen are all famous througout the country in connection with the wire trade, and it makes no difference what wire they handle, so long as it is first-class, their reputation will fetch business. These gentlemen, anyway, know nothing about wires that are not first-class, and the trade knows them well enough to know that they will never touch anything that has no merit.

An Immense Ruhmkorff Coil.—The International Electric Co., 76 Beekman street, New York, is making a Ruhmkorff coil which is guaranteed to give a 20-inch spark. The spool is 12 inches in diameter by 30 inches in length. There are 75 pounds of No. 36 wire in the secondary coil and 11 pounds of No. 6 in the primary. The coil requires nine cells of primary battery to work it to its full capacity. The voltage of this immense spark will be between 150,000 and 200,000 volts. The coil complete will weigh over 200 pounds. It is said to be the largest coil ever made in this country. A mercury vibrator will be used in its operation. Mr. B. Tropp is the electrician of this company and is the designer of this great coil. The company is meeting with great success.

Found at Last.—A resident of Clydebank, England, has patented a primary battery which, he says, will generate electricity for lighting at an incredibly small cost and will drive an Atlantic liner across the ocean at a speed of 40 to 60 knots an hour. Poor fellow!

Rapid Transit Report.—We have received, with the compliments of William Barclay Parsons, chief engineer of the Rapid Transit Commission, a copy of his report to that body on "Rapid Transit in Foreign Cities." The report gives a detail description of all the foreign systems of rapid transit and an account of the American practice and other valuable information relating to the subject. It is profusely illustrated and will serve as a valuable work of reference on the subject of rapid transit.

Railway Car Lighting.—The railway postal cars running between Frankfort-on-the-Main and Basle are lighted by electricity from accumulators.

Book Catalogue.—We have just issued our Book Catalogue; it is completely revised up to date. Send for copy.

PECKHAM'S NEW "EXCELSIOR" TRUCK.

The Peckham Motor Truck & Wheel Company, New York city, are now placing upon the market a new truck designed by their president, Mr. Peckham, to meet the requirements of certain roads that favor a cheaper construction than their all-steel, machine-fitted trucks.

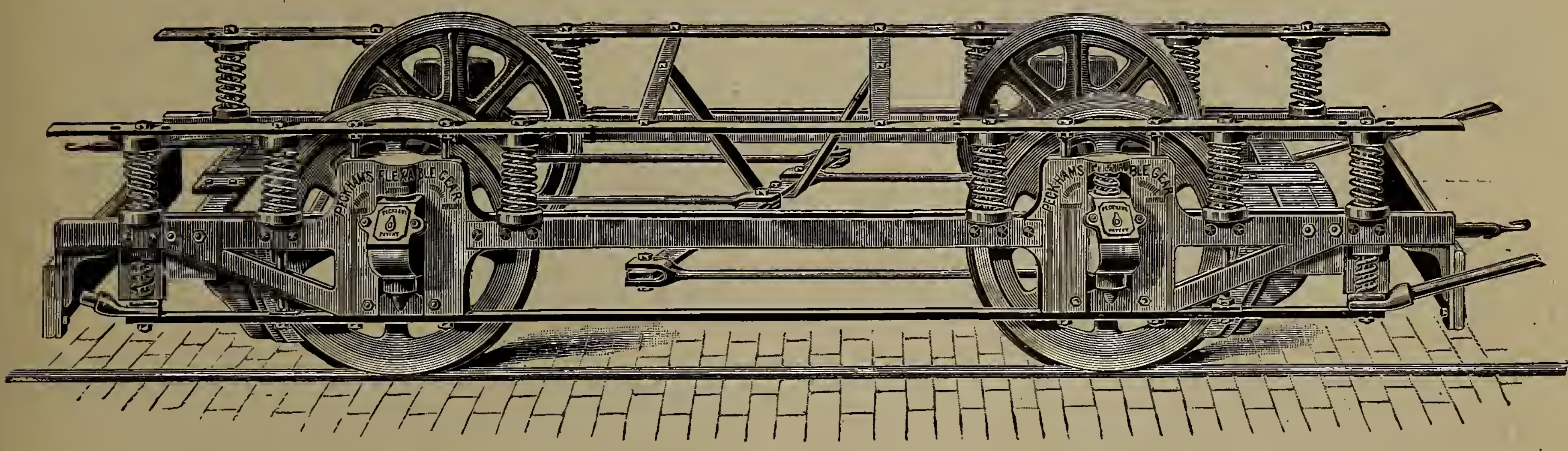


FIG. 1.

The new "Excelsior" trucks are constructed upon the same general principle as Peckham's Cantilever Extension Truck. The pedestal and spring supports are cast in one piece and secured by hot driven rivets, no bolts being used in its construction. It is provided with a steel top frame, connecting the different springs. It is so constructed that it can be used as a "trailer" truck, as shown in Fig. 1; as a motor truck, with all spiral springs, as shown in Fig. 2, or as a motor truck with both spiral and elliptic springs, as shown in Fig 3. Its yokes are provided with Peckham's flexible gear, which supports the truck frame upon the journal boxes by graduated spiral springs; it is also provided with Peckham's dust-tight, self-lubricating journal boxes, and with truss extension for open cars, when so desired.

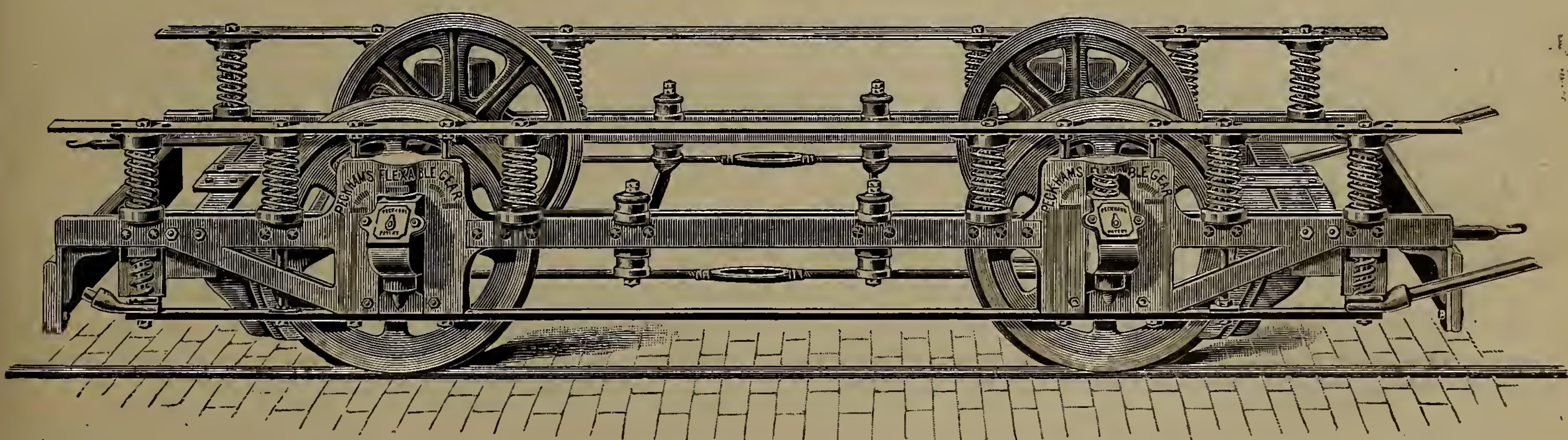


FIG. 2.

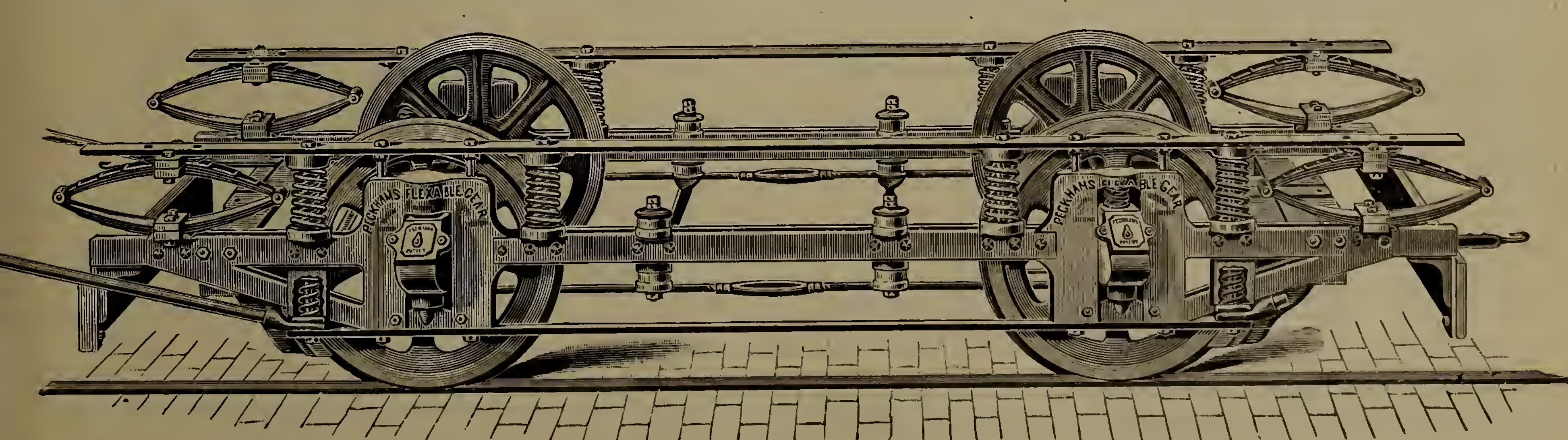


FIG. 3.

Although somewhat lower in price than their all-steel, machine fitted trucks, these trucks are made with the same degree of care as to details as is used in the construction of all Peckham trucks. These trucks are guaranteed to give entire satisfaction as to easy riding, and to be the strongest and best made low-priced truck in the market.

Further details of these trucks and price list can be obtained at the company's general sales office, 23 Cortlandt street, New York, or at their branch offices in Boston, Chicago, Philadelphia, Pittsburgh and San Francisco.

MARRIED.—Mr. John B. O'Hara, managing editor of the *Western Electrician*, Chicago, on December 27, last, was married at Rochester, N. Y., to Miss Margaret Hickey of that city. The ceremony took place in the Convent of Mercy, and was conducted by the Rev. O'Hanlon. The happy couple then started for the East and South on their bridal trip. Mr. O'Hara is well-known in the electrical trades, and all, THE ELECTRICAL AGE included, wish him and his bride a long life of happiness and prosperity.

THE CLEVELAND CONVENTION.

We are informed by Mr. C. O. Baker, Jr., Master of Transportation National Electric Light Association, that the Central Traffic Association has granted the Electric Light Association's application for excursion rates to the Cleveland meeting, February 19, 20 and 21 next. The rate from all points within the territory of the Central Traffic Association to Cleveland will be a fare and one-third, on the certificate plan. The other associations will undoubtedly concede the same privileges. Due notice of this will be given.

THE OTTAWA WINTER CARNIVAL.

Mr. T. Ahearn, managing director of the Ottawa Electric Railway and a member of the American Institute of Electrical Engineers, in behalf of the carnival management extends a hearty invitation to his fellow-members and their friends to visit Ottawa, Ont., during the week of the grand winter carnival, January 21 to 26.

The many attractive features of the Canadian capital city are well known to travelers, and Ottawa is generally recognized as the electrical headquarters of the Dominion.

NEW RESISTANCE MATERIAL.

Wm. F. Atwood, of Orange, N. J., has invented a process of carbonizing cord and leaving it so tough that it can be insulated like other wires and wound upon spools or bobbins. The value of this invention lies in the high resistance of the carbon cord. The Electric Bell and Resistance Company, of Newark, N. J., has been incorporated to manufacture Mr. Atwood's new resistance material. With the use of this substance ordinary bells may be operated on electric light or electric railway circuits.

"HAPPY NEW YEAR AND KERITE WIRE."

We have received from S. F. B. Morse & Co., Chicago, a neat and pleasing New Year's greeting. It consists of a small bottle of "Old Coronet" rye whiskey and a fine cigar in a sealed glass tube, both packed in a neat box. The firm takes occasion to remind the recipient of these two good things, that Kerite is another good thing that cannot be got along without, a liberal use of which (Kerite of course) is recommended.

HEAVY VERDICT.—On January 2, the jury in the case of Edward McMullen against the Western Union Telegraph Company, which was tried in Newark, N. J., gave judgment in favor of McMullin for $25,000. The action was for injuries received in Jersey City, last June, while McMullin was working as a lineman upon a pole. He was nearly killed by coming in contact with an electric light wire. Besides being badly shocked, his foot, leg and body were severely burned and the sight of one eye was destroyed. McMullin sued for $60,000.

ANNUAL MEETING OF THE OKONITE COMPANY, LTD.

The annual ordinary general meeting was held by the Okonite Company, Ltd., at the New York office of the company, No. 13 Park Row, December 27, 1894, Mr. Edward Lyman Short presiding. A large percentage of the stock was represented.

Reports from the heads of the several departments showed a good business transacted by the company during 1894, and substantial indications that the business of the new year just entered upon is to be still better.

The meeting adjourned after re-electing the auditors.

EXHIBITION OF PATENTS AND INVENTIONS.

The Commercial Exhibition Company, of New York City, will hold an International Exhibition of Patents and Inventions, beginning on or about March 1 next, and continue the same for one month. The object of the exhibition is to show the progress made during the past decade.

This exhibition will offer an excellent opportunity to inventors to bring their patents or designs before the public, and will bring patentees into contact with the most substantial elements of industrial progress.

It is proposed by the management of the exhibition to have lectures on technical novelties, electrical inventions, etc., and persons of prominence in the electrical field are to be invited to participate in this feature.

An interesting feature of the exhibition will be the display of plans and models for rapid transit in New York City.

A jury, composed of prominent business men and scientists, will award medals and diplomas to exhibitors.

The exhibition will be held in the Grand Central Palace, Lexington avenue and 43d street, New York City.

Mr. John V. Pohl is president and general manager of the exhibition, with offices at the above address.

Telephone Notes.

Telephone communication has been established between Vienna and Linz, Austria, thus connecting the upper and lower divisions of that country.

A telephone exchange will be established in Danville, Ky., by L. Eddy.

The Corsicana Mutual Telephone Company, Corsicana, Tex., the incorporation of which was noted last week, has been granted a franchise by the city and expects to establish an exchange of about 200 subscribers. Josh. Audry is president of the company.

The Chicago Telephone Company, Chicago, Ill., will erect an exchange on 45th street, that city.

The Anthony Company, of Cincinnati, Ohio, has been organized to manufacture and deal in telephone supplies, and build and operate telephone lines. (See Possible Contracts column.)

TELEPHONE PATENTS ISSUED JANUARY 1, 1895.

TELEPHONE INDICATING APPARATUS.—John I. Sabin and William Hampton, San Francisco, Cal. (No, 531,650.)

Financial.

The following statement shows the financial operations of the Binghamton Railroad Company, Binghamton, N. Y., for the six months from July 1 to January 1, 1894, as compared with the same period of the preceding year :

	1893.	1894.	GAIN
Receipts	$57,654.32	$70,913.16	$13,258.84
Operating Expenses	31,394.20	36,403.48	
	26,260.12	34,509.68	
Taxes	1,400.	1,551.	
Net Earnings (6 months)	24,860.12	32,958.68	8,131.56
Operating percentage of receipts	54½ per ct.	51¼ per cent.	

Percentage of gain in receipts, 1894 over 1893, 23 per cent.

Percentage of gain in net receipts..........32¾ per cent.

New Corporations.

The California Electric Light and Power Company, California, Mo., by W. H. Mengel, J. P. Gray, F. W. Sarman and others. Capital stock, $6,000.

The Buckeye Gas Company, Circleville, Ohio, by J. B. Bradley and others. Capital stock, $300,000. Will build electric plants.

The Anthony Company, Cincinnati, O., by Mark O. Anthony, Louis Feeder, Max Silberberg, Lipman Levy and Archibald Stuart. Capital stock, $200,000. Will deal in electrical supplies.

The Columbus Illuminating Company, Columbus, O., by R. J. M. Danley, Ed. H. Zurhorst, W. D. Park, W. A. Hardesty, Chas. A. Field and Eugene Lane. Capital stock, $25,000.

Kings County Electric Light and Power Company, Brooklyn, N. Y., by Edwin C. Lowe, Brooklyn, N. Y., and others. Capital stock, $1,000,000.

Trenton Traction Company, Trenton, N. J., by E. J. Moore and others. Capital stock, $500,000.

Possible Contracts.

The City & Suburban Railway Company, of Baltimore, Md., will build a bridge of pile construction, with a steel draw span. F. H. Smith is the designer.

A franchise for the erection of an electric light plant in Montgomery City, Mo., has been granted to Geo. J. Ferguson & Co.

It is likely that Webb City, Mo., will establish an electric light plant of its own with a capacity of 2,000 incandescent and 100 arc lights. For further particulars address Mayor Funk.

R. A. Long, of Beaufort, S. C., can give particulars regarding machinery necessary for an electric light plant in that place.

Joel Gutman & Co., Baltimore, Md., propose to make improvements to their building, including an electric light plant. The improvements will cost about $100,000.

The Mobile & Ohio Railway contemplates the building of large warehouses at some point between Meridian, Miss., and Jackson, Tenn.

The Missouri, Kansas & Texas Railway have planned to erect a passenger depot at Sedalia, Mo.

Paul W. Connor, Washington, D. C., has been granted a permit for the erection of a theatre to cost $250,000. It will be equipped with the latest improvements and conveniences. Wood & Lavelle, Chicago, are the architects and builders.

The Asheville & Biltmore Street Railway Company, Asheville, N. C., will build a line about two miles long to the Vanderbilt estate.

It is stated that the York Southern Railroad will be equipped by electricity. This line is the northern section of the Baltimore & Lehigh Railroad and is 35 miles in length. The president of the company is W. F. Walworth, Cleveland, O.

The Fort Worth Street Railroad Company, Fort Worth, Tex., will make extensive improvements in its system.

The Nashville Street Railroad Company, Nashville, Tenn., which was recently reorganized, will make several improvements and extensions to the system.

An electric road is proposed to connect with the New Orleans City & Lake Railroad, in St. Bernard Parish, La. H. T. Beauregard and J. T. St. Alexander, of Missouri, are interested.

An electric railroad is to be built from Ocala, Fla., to Silver Springs. It will be named the Silver Springs & Western Railroad. F. A. Teague and A. McIntyre are interested.

G. W. Baxter, Hot Springs, Ark., is interested in the scheme to build an inclined cable railway up West Mountain, for which a company has been now organized.

Trade Notes.

Pepper & Register, electrical engineers and general contractors, Philadelphia, Pa., have removed their offices from the Provident Building to 1414 South Penn Square, that city.

Mr. Charles D. Shain, representative of the Weston Electrical Instrument Company, 136 Liberty street, New York City, sends out hearty New Year's greetings to the trade. We return the compliment.

Linton & Southwick, of Worcester, Mass., manufacturers of switches and switchboards, have just issued a new catalogue and price-list of station switches and apparatus manufactured by them.

The George L. Colgate Co., 136 Liberty street, has a few of the celebrated Roulette cycles for sale at special prices. These wheels are new. Every one in the electrical business should ride a wheel.

Messrs. Herrick & Burke, supervising, designing and consulting electrical engineers, have just opened offices at 203 Broadway, New York. They have had long experience as experts on the three-wire system for electric railways. Their combined factory experience of sixteen years, together with their long years of study of electrical apparatus and the practical handling of the same, fit them in a high degree for the business in which they have engaged. With their technical and practical knowledge, as above noted, they are eminently capable of giving counsel, estimates, etc., on all subjects and plans relating to the transmission of electrical power for all purposes. They have had large experience with station equipment. The firm consists of Albert B. Herrick and James Burke, both gentlemen being well-known in the trade.

WOVEN WIRE BRUSHES.

The Belknap Motor Co., of Portland, Maine, are the patentees and manufacturers of the best woven wire commutator brush on the market.

ELECTRICAL and STREET RAILWAY PATENTS

Issued January 1, 1895.

531,623. Armature for Dynamo-Electric Machines or Motors. Ward Decker, Owego, N. Y. Filed Nov. 17, 1892.

531,626. Car-Fender. William A. Donor, Jersey City, assignor of one-third to Michel J. O'Keefe, Paterson, N. J. Filed Oct. 6, 1894.

531,635. Electric-Wire Holder or Insulator. Albert Iske, Lancaster, Pa. Filed May 29, 1894.

531,650. Telephone Indicating Apparatus. John I. Sabin and William Hampton, San Francisco, Cal. Filed July 25, 1894.

531,651. Electric Block-Signal. Charles H. Sallada, Pittsburgh, Pa. Filed Apr. 9, 1894.

531,657. Transmuter for Electrical Currents. William J. Still, Toronto, Canada, assignor of one-half to Randolph MacDonald, trustee, same place. Filed Apr. 5, 1893. Patented in Canada June 28, 1893, No. 43,408.

531,663. Base for Incandescent Electric Lamps. George C. Thomas, South Framingham, Mass. Filed Nov. 28, 1893.

531,664. Closed Conduit for Electric Railways. Robert J. Turnbull, St. Paul, Minn., assignor of one half to Augustus F. Priest, same place. Filed Jan. 19, 1894.

531,669. Indicator for Electric Currents. Edward Weston, Newark, N. J. Filed Feb. 21, 1894.

531,698. Electric Arc-Lamp. Charles A. Pfluger, Chicago, Ill., assignor to the Standard Electric Company, same place. Filed Apr. 5, 1894.

531,707. Brush for Dynamo-Electric Machines. John B. Wallace, Ansonia, Conn., assignor to the Wallace Electric Company, of Illinois. Filed Apr. 30, 1894.

531,708. Electric Signal. William J. Wessenberg and Horatio F. Wilbur, Meriden, Conn. Filed Aug. 12, 1893.

531,709. Electro-Magnet. William J. Wessenberg and Horatio F. Wilbur, Meriden, Conn. Filed Sept. 27, 1894.

531,751. Electric Arc Lamp. Albert Schweitzer, Allegheny, Pa., assignor of two-thirds to Frederick Goellner, same place, and Conrad Weber, Shaler, Pa. Filed June 22, 1894.

531,764. Electric Car-Lighting Apparatus. William Biddle, Brooklyn, N. Y. Filed May 8, 1894.

531,765. Circuit-Regulating Device in Electric Car-Lighting Apparatus. William Biddle, Brooklyn, N. Y. Filed May 28, 1894.

531,790. Method of Operating or Controlling Electric Motors or Dynamos. Rudolf Eickemeyer, Yonkers, N. Y. Filed Nov. 2, 1891.

531,837. Trolley. Theodore Cooper, Providence, R. I. Filed Sept. 17, 1894.

531,839. Safety Guard or Fender. Philip Elsworth, Jr., Bayonne, N. J. Filed Sept. 1, 1894.

531,849. Electric Steam-Engine Governor. Chester B. Melott, Rondout, N. Y. Filed July 21, 1894.

531,866. Method of and Means for Measuring Energy of Alternating Electric Currents. Oliver B. Shallenberger, Rochester, Pa. Filed Sept. 19, 1894.

531,867. Method of and Means for Measuring Alternating Electric Currents. Oliver B. Shallenberger, Rochester, Pa. Filed Sept. 19, 1894.

531,868. Indicating Watt Meter for Alternating Electric Currents. Oliver B. Shallenberger, Rochester, Pa. Filed Sept. 19, 1894.

531,869. Watt Meter for Multiphase Alternating Electric Currents. Oliver B. Shallenberger, Rochester, Pa. Original application filed Sept. 19, 1894. Divided and this application filed Nov. 24, 1894.

531,870. Alternating Current-Measuring Instrument. Oliver B. Shallenberger, Rochester, Pa. Filed Nov. 24, 1894.

531,873. Electric Railway. Abraham A. Shobe and Wm. Embley, Jerseyville, Ill. Filed July 24, 1894.

531,890. Coin-Controlled Electrical Musical Instrument. Philip Wuest, Jr., Philadelphia, Pa. Filed Sept. 12, 1893.

531,908. Street-Car Fender. Matthew A. Cherry, Washington, D. C. Filed Oct. 3, 1894.

531,919. Electric Railway Signal. Jake Frank, New York, N. Y. Filed Nov. 27, 1893.

531,929. Safety Device for Electric Circuits. Thomas Harden, London, England. Filed Apr. 27, 1894.

531,961. Circuit-Controller. Thomas Parker, John H. Woodward and Edmund S. G. Rees, Wolverhampton, England. Filed Feb. 24, 1892. Patented in England, Aug. 18, 1891, No. 13 942.

531,962. Distribution of Electricity. Thomas Parker, John H. Woodward and Edmund S. G. Rees, Wolverhampton, England. Filed Feb. 24, 1892. Patented in England, Oct, 10, 1890, No. 16,110, and Oct. 24, 1891, No. 18,348.

531,970. Electrostatic Voltmeter. Henry A. Rowland, Baltimore, Md. Filed Feb. 24, 1894.

531,996. Electric Converter. Robert H. Hassler, Pittsburgh, Pa, assignor to the Westinghouse Electric and Manufacturing Company, same place. Filed Apr. 30, 1894.

532,003. Electric Signalling Apparatus. George E. Miller, Saugus, Mass., assignor to the American Electric Train and Switch Signal Company, Portland, Me. Filed Jan. 24, 1894.

532,009. Electric Semaphore-Setting Device. Homer A. Parrish, Jackson, Mich. Filed Feb. 10, 1894.

ELECTRICAL AGE

Vol. XV., No. 3. NEW YORK, JANUARY 19, 1895. Whole No. 401

Established 1883.

Entered at New York P. O. as second-class matter, January 18, 1891.

THE ELECTRICAL AGE PUBLISHING CO., Publisher

TERMS OF SUBSCRIPTION:

One Copy, one year,	$3.00
One Copy, six months,	1.50
Great Britain and other Countries,	4.00

Cable Address (all Cables,) "Electage," New York.

W. T. HUNT, President F. N. BASSETT, Vice-President.

T. R. TALTAVALL, Secretary and Editor.

NEWTON HARRISON, E. E., Scientific Editor.

ADDRESS ALL COMMUNICATIONS TO

THE ELECTRICAL AGE PUBLISHING COMPANY,

First Floor, World Building.

NEW YORK.

NEW YORK, JANUARY 19, 1895.

CONTENTS.

THE BIG STRIKE IN BROOKLYN.

A great struggle is now in progress in Brooklyn between all the street railroad companies, save one, and their employés. Early in the morning of January 14 the strike was declared; as the cars reached the barn they were deserted by motormen and conductors, in obedience to orders from their Union. At least 6,000 men thus stopped work, and the great electric railway systems were completely paralyzed. During the day several attempts were made to run passenger cars with new hands, but the tactics of the strikers and their sympathizers prevented the success of this move on the part of the railroad companies. In some instances violence was resorted to, and the police had all they could do to handle the mob without taking extreme measures. The mail cars were run on fairly good time, but the passenger service was at a complete stand-still. Regarding the causes which led up to the strike, the railroads officials assert that to grant the requests of the men would increase the expenses more than the companies could bear, and they claim that the action of the committee representing the men in declaring a strike was unreasonable and hasty. As to the rights and wrongs in the case, no doubt a compromise could have been effected had more confidence existed between the contending parties. The companies made official declarations of what they could and would do, and what they could not do, but yet the men seem to have had a suspicion that the companies were acting insincerely towards them. When such a feeling exists on one side it is useless to try to do or say anything to set matters to rights. To come to an understanding confidence in each other should exist. There is no doubt that the conductors and motormen are poorly paid for the character of service they render, but that is not altogether the fault of the railroad companies. Labor is as much regarded a commodity, purchasable and salable, as is dry-goods or other merchandise. The railroad companies get it for the least cost to themselves, and they are aware of the fact that there are thousands of men out of work who would be glad to get the positions deserted by their former employés at the old rates of wages. This state of things has a tendency to further reduce wages, and no doubt it is due mainly to the fear of trouble and disorganization of the systems by strikes that the companies are prevented from making further encroachments on the men's earnings. To increase the compensation of 6,000 employes, however small an amount, involves considerable additional expense, and companies already operating under very heavy expenses are compelled to go carefully in this direction. We do not believe that railroad corporations are the embodiment of everything good and just, but they have interests to protect just as an individual has. At this stage it is impossible to predict the result of the struggle. From the fact, however, that there are plenty of men available to take the places of the strikers, the prospects for victory on the part of the employés is not assuring. If the strikers would use moral force alone in their cause they would stand a better chance of winning, but it is well-known that violence invariably attends a large strike, and to protect their property and enable them to conduct their operations the companies are compelled to call on the municipal and sometimes the state authorities for protection against mob violence. The police and military stand as ready to protect the individual in case of necessity, but, as a rule, the protection is needed on the other side. The railroad companies use no violence against their men or their property, therefore the men need no protection; but when the railroads call for protection the men set up the cry that the authorities act in favor of capital and against labor. The exercise of more of the spirit of justice and forbearance between the principals is needed in dealing with such questions.

EXPERIMENTAL INVESTIGATIONS INTO THE ORIGIN OF FRICTIONAL ELECTRICITY.

BY C. CHRISTIANSEN.*

In seeking for the origin of frictional electricity, it is necessary to consider in the first place what sources of electricity are available. Besides friction we have pressure and impact, but they lie so close to friction that they are of no use to us. The remaining sources of electricity to be more especially examined are, contact electricity, thermo-electricity and induction. There is no analogy between induction and friction as sources of electricity: the origin of thermo-electricity is still very doubtful; but there is a great analogy between frictional and contact electricity.

In his discussion of electrical boundary layers, Helmholtz † starts from this analogy. If two different bodies come into contact, there arises a potential difference $v_1 - v_2$. Let the charges of the electrical layers which are thereby formed, per unit of surface, be δ and $-\delta$. If their distance apart be a, then we have $\delta = (V_1 - V_2)\ 4\pi a$. If the bodies could be separated without discharge, the surfaces must retain the charges δ and $-\delta$. As a matter of fact, a partial discharge always takes place, which in the case of conductors is almost complete, but, if one or both of the bodies is an insulator, a very considerable charge is retained.

To show the consequences of this idea, we shall make the following experiment. Let A, fig. 1, be a metal plate; B, a metal rod, and C, an insulating handle. We coat the plate A, with an insulating material, II, for example, by dipping it in melted pitch or resin. A glass dish, D, is filled with mercury, and the mercury as well as the plate, A, are connected to the poles of a galvanometer, E. I used a Kelvin galvanometer with a resistance of 6,400 ohms, which gave a deflection of one cm., with a discharge of 100 electrostatic units. If now the surface of the pitch is brought in contact with the mercury, no deflection whatever takes place on the galvanometer, but when they are separated a very considerable deflection is obtained, even though the surface of contact is only a few square centimetres. The current flows from the mercury through the galvanometer to the metal plate. According to Helmholtz, this experiment is to be pictured in the following way. When contact is made the mercury takes a potential v_1 and the pitch a potential v_2 at the surface of contact. An electric current now flows through the galvanometer till the plate A is brought to the potential v_1. Let a' be the thickness of the coating of pitch and κ the coefficient of induction of the pitch, then the surface density δ' at the surface of contact between A and II will be approximately

$$\delta' = \frac{\kappa (v_1 - v_2)}{4 \pi a'}$$

Here $v_1 - v_2$ is certainly small (not more than a few volts), and a' is a finite quantity; δ', therefore, is of inconsiderable amount and the current in this case will not be indicated by ordinary measuring apparatus. We can now, therefore, make the statement, *no electric current is produced when an insulator is brought into contact with a conductor.*

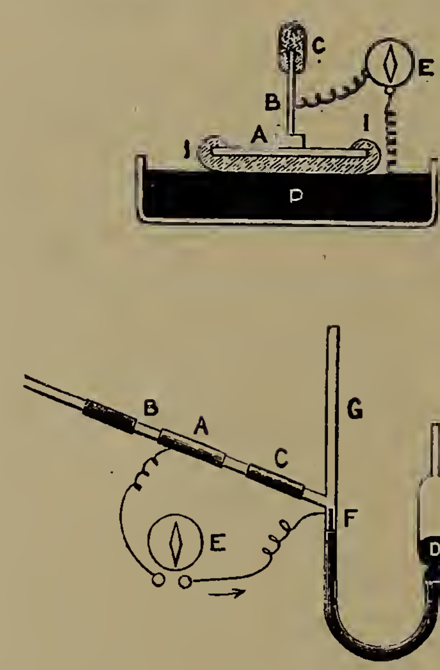
If we now raise the plate from the mercury the pitch becomes negatively electric. If no reunion of the charges takes place the surface density must have the value

$$\delta = \frac{v_1 - v_2}{4 \pi a}$$

A corresponding quantity of electricity must, therefore, flow through the galvanometer to the plate A, and the ratio of the currents at contact and on separation, to each other will be $\delta' : \delta$ or $\kappa a : a'$. As a matter of fact, partial reunion takes place and the ratio is not quite equal to $\delta' : \delta$.

If we bring the pitch again in contact with the mercury the pitch again shows a deflection; the current now goes from the metal plate through the galvanometer to the mercury; this current is usually much smaller than the separation current, in the case of pitch about one-third, in other cases it may amount to two-thirds. The diminution is due partly to leakage into the air and partly to absorption by the dielectric.

As the results obtained with the above apparatus were somewhat uncertain, another form, illustrated in fig. 2, was devised. B, C, is a glass tube 10 to 15 cm. long, the inside diameter being three to six mm. The tube is coated inside with the insulator to be investigated, either by dissolving in some solvent such as benzol or carbon disulphide and sucking the solution into the tube, or by melting the insulator and coating the inside of the tube with a thin layer. Round the middle of the tube a strip of tinfoil, A, is wrapped, covering about four to six cm. of the tube. The tube, A, B, is connected to a T tube, F, G, by a piece of india-rubber tube. A mercury reservoir, D, is connected to F by a length of india-rubber tube, sufficient to allow the reservoir to be raised and lowered. A platinum wire



FIGS. I AND 2.

is melted through the tube, F, to put the mercury in the tube in contact with one pole of a galvanometer, E, the other pole of which is connected to the tinfoil strip, A. With this apparatus, the experiments above described can be easily repeated. By raising D, the contact between the mercury and the insulator in the tube is made; by lowering D the separation takes place. When the tube at B is open, we obtain the same results as with the first apparatus, since the experiments in both cases are made in atmospheric air; but if we bring in another gas through B and out through G, the circumstances are partly different, as will be seen further on.

Numerous experiments were made with this apparatus with a considerable number of different insulators such as pitch, resin, sealing-wax, shellac, dried turpentine, mastic, paraffin, camphor, &c., which were coated on to the inside of the tube as already described. These insulators were tested in atmospheres of air, of hydrogen, and of carbonic acid gas.

Pitch, in atmospheric air, always becomes negative when in contact with pure mercury. But in an atmosphere of hydrogen, which has been thoroughly freed from oxygen, pitch becomes positive. Before this experiment succeeds, the pitch must be warmed sufficiently to give off any oxygen which may be adhering to its surface. The other insulators tested all behaved very much in the same way.

These experiments all showed the importance of the presence of oxygen in the development of electricity by the contact between mercury and insulators. If we hold by Helmholtz's theory, according to which frictional and con-

* *Wied. Ann*, 53, p. 401, 1894.
† *Wied. Ann*, 7, p. 335, 1879.

tact electricity are essentially the same, we can now understand that a body when rubbed with a given substance may become sometimes positively, sometimes negatively electric; it all depends whether the oxygen is removed by the rubbing or not. Also it can be understood why two apparently identical bodies when rubbed may become differently electrified.

The insulators investigated were all combustible, and there can be little doubt that a layer of oxygen was condensed on their surface. It is well known that in glass tubes in which mercury is often raised and lowered, a gray powder is formed under the action of atmospheric air. This probably consists, chiefly, of a compound of mercury and oxygen; this compound I shall here designate as HgO, though, possibly, there are other compounds, perhaps Hg_2O. I believe that in the experiments that have been described in presence of oxygen, a small quantity of this compound is formed when mercury is brought in contact with an insulator. We have then the scheme

+—
Mercury, HgO, pitch.
+ —

Hg being the cation, and O the anion, in the compound, HgO. On separating the mercury from the pitch, the

MIANUS ELECTRIC CO.'S NEW TRANSMITTER.

oxygen anion remains with the latter, the Hg cation follows the mercury, and we now have the scheme

+ —
Mercury, Hg, O pitch.

According to this, therefore, the pitch becomes negatively electrified because it is covered with oxygen anions, and a positive charge is produced on the mercury through the presence of mercury cations. Free electricity has no more existence here than it has in the case of other methods of producing electricity.

After considering the whole of the experiments, I have come, without hesitation, to the conclusion that friction by itself does not excite electricity; the effects which are usually ascribed to friction arise from chemical decomposition, which is initiated on contact and consummated on separation The formation of double layers assumed by Helmholtz is to be looked upon as a polarization of the double atoms of the molecule, wherein the cations form the positive and the anions the negative layer. On separation the cations are left adhering to one body and the anions to the other body, and thus the bodies receive their electrical charges. This theory agrees with the views developed by Helmholtz in his Faraday lecture. According to him, every atom has a certain charge of electricity, depending on its size, which may be either positive or negative according as the ion makes its appearance as a cation or an anion; the combination of the two make the electrical neutral molecule.

PHYSICAL UNITS.—We have received a copy of Bulletin No. 1, of the Rose Polytechnic Institute, Terre Haute, Ind., for the year 1894–95. The subject of the Bulletin is "Physical Units," by Thos. Gray, Professor of Dynamic Engineering. The work is very complete and will be valuable to all interested for reference.

NEW TELEPHONE TRANSMITTER.

We give herewith an illustration of a new telephone transmitter, which has just been put upon the market by the Mianus Electric Company, of Mianus, Conn. It is a regular Hunnings transmitter and is said to be a very distinct speaking instrument. It can be placed on the front of a magneto bell box or upon an adjustable arm, so as to be raised and lowered to the height of the person speaking into it.

In its construction, provision has been made to guard against the packing of the granular carbon. This is one of the features of the transmitter and always insures a reliable working instrument. The Hunnings transmitter is well-known for its loud speaking qualities and the instrument of the Minaus Electric Company, no doubt, will be received with favor in the trade.

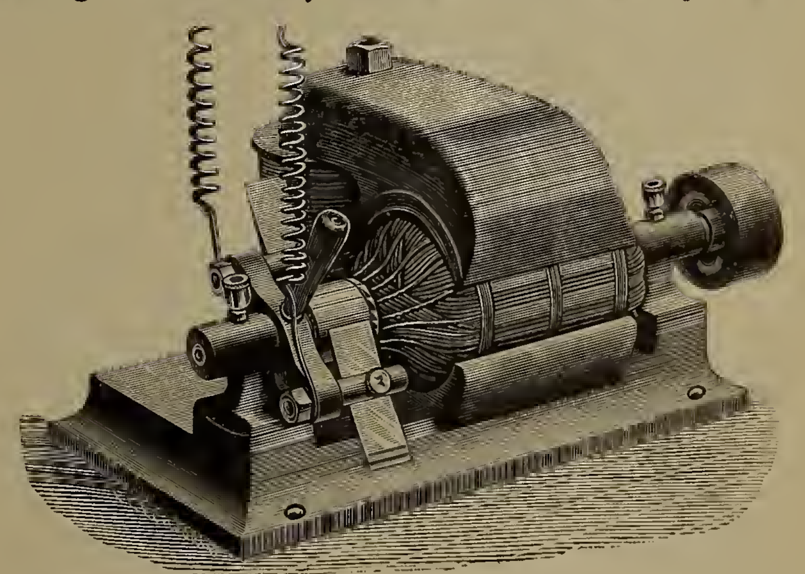
This firm also makes a large line of other first-class transmitters and other telephonic apparatus. In our last issue we gave a detailed account of some of these instruments, to which we refer our reader.

THE ELBRIDGE DYNAMO.

A five-light dynamo has been recently put on the market by the Elbridge Electrical Manufacturing Co., of Elbridge, N. Y., embodying features that will make it popular with many who desire a thoroughly reliable small machine at a moderate price.

The dynamo is well made in all its parts, and is designed for constant use. The magnetic circuit is short, insuring the strongest possible magnetizing power, and the pole-pieces and magnet-core are made of specially treated iron, which is far superior to cast iron and nearly equal to wrought, without the attendant expense of the forgings. This quality of iron is found in no other machine, and while it insures greater efficiency, largely reduces the expense.

The armature is built up of thin disks of soft wrought iron, each insulated from the next, securely clamped together by means of a turned sleeve and nut. It has milled grooves in which the coils are wound, thus increasing the efficiency of the machine and preventing



ELBRIDGE DYNAMO

injury to the insulation of the wires. The coils are rigidly held in place in the grooves by three bands of spring brass wire wound tightly and soldered. The core is balanced perfectly both before and after winding, insuring smooth and noiseless operation. Double covered wire is used throughout.

The bearings are solid and symmetrical; the base is turned on the arc of a circle of the same diameter as the bearing-seats and pole-pieces, and the latter are bored at one operation, insuring perfect alignment of bearings and a true running shaft. All bearings are fitted with brass oil cups.

The shaft is of high grade steel running in bushings of bronze metal, which are easily replaced.

The machine is 7½ inches high, 9 inches wide, 13 inches

long, and weighs 52 pounds. At a speed of 2,700 revolutions per minute it will light to full incandescence, without heating or getting out of order, five lamps of 16 candle-power, or eight lamps of 10 candle-power. It may be handled with perfect safety by persons unfamiliar with electricity, as there is absolutely no danger of shock, and it does not easily get out of order.

It requires one-half horse-power to operate it at full capacity, and is especially well adapted to lighting manufactories and offices, and where the number of lights required is too small to justify the employment of an electrical expert to run them.

PRINCIPLES OF DYNAMO DESIGN.

BY

Newton Harrison, E.E.

(*Continued from Page 343, Vol. xiv.*)

An approximation bringing us to within 15 or 20 per cent. of the true value of leakage according to one writer, will be sufficiently close for practical purposes. By a careful consideration of the surfaces lying near to each other and the proper determination of the magnetic pressure acting between them, the predetermination of the leakage factor becomes a matter of great surety, though involving tedious labor of a somewhat empirical character.

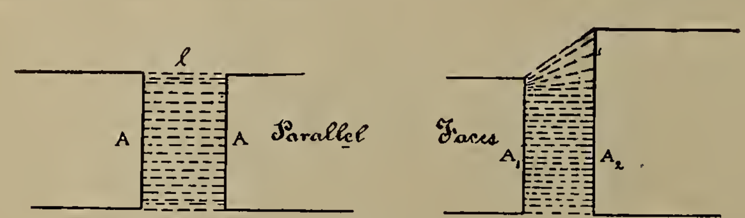


FIG. 16.

All parallel surfaces can have their reluctance determined by a very simple method. If two sets of surfaces be considered as represented in fig. 16

R = reluctance
l = distance
A = area of surface

$$(1) \qquad R = \frac{l}{A}$$

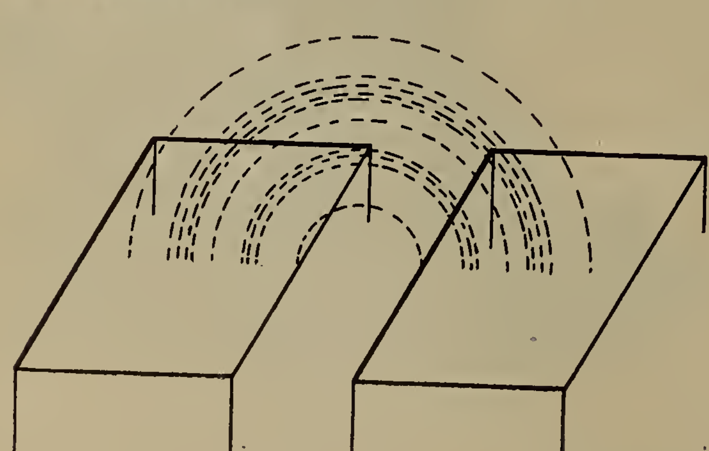


FIG. 17—SURFACES IN THE SAME PLANE.

The reluctance of the first case will be $\frac{l}{A}$, and of the second the distance divided by the mean surface, or

$$(2) \qquad R = \frac{l}{\frac{A_1 + A_2}{2}} = \frac{2\,l}{A_1 + A_2}$$

If the two cases just given be grouped under one heading as: Two parallel surfaces of equal and unequal areas, then those surfaces may be also grouped into one class which lie in the *same* plane. See fig. 17.

The distance between surfaces in this position may vary, that is to say, the distance between them measured in the same plane in which they lie. This would naturally vary the reluctance and bring into existence an infinite number of cases to be considered.

It is not the object of the writer to recommend these methods as being the best, because leakage calculations involve other variable quantities, whose use will present doubtful issues to our mind. For instance, the magnetic potential cannot be known with any great degree of accuracy at different parts of the frame. Mr. Ravenshaw, of the English firm of W. T. Goolden & Co., has made calculations from the sketches of machines to within two per cent. of their actual values.

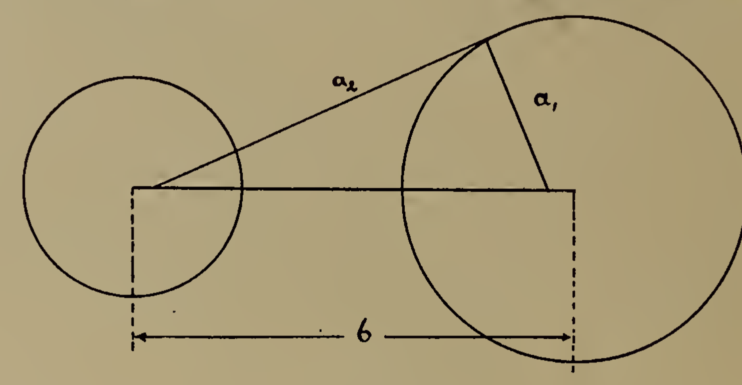


FIG. 18.

This assuring statement made by a well-known author tends to invite confidence in the use of methods which can be carried out with such success. New formulæ, however, would be necessary for every difference of position occupied by the iron parts; therefore, to cover the general run of cases, these three conditions are presented. (1) Parallel faces. (2) Surfaces lying in the same plane. (3) Two parallel cylinders. The last case is well covered by a table of Dugald Jackson's, in which different values are given for the ratio expressing the distance between the axes and the diameter of the cylinders (fig. 18).

Table showing the magnetic reluctance in C. G. S. units

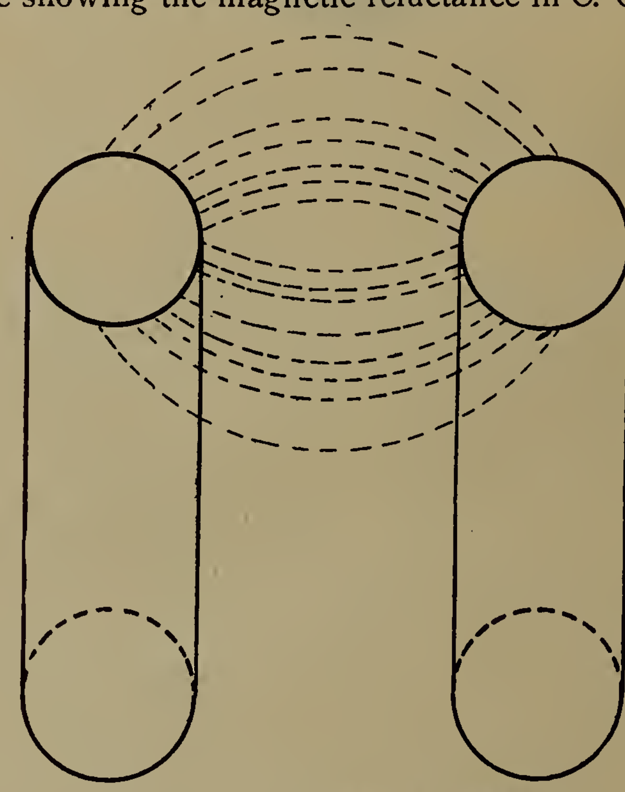


FIG. 19—PARALLEL CYLINDERS.

between unit lengths of two equal parallel cylinders, fig. 19, surrounded by air and having various values of the ratio $\frac{b}{d}$.

$\frac{b}{d}$	Reluctance per cm.	$\frac{b}{d}$	Reluctance per cm.	$\frac{b}{d}$	Reluctance per cm.
1.25	.19	4.	.655	7.5	.86
1.50	.30	4.5	.67	8.	.88
1.75	.337	5.	.73	8.5	.90
2.	.42	5.5	.76	9.	.92
2.5	.50	6.	.79	9.5	.94
3.	.556	6.5	.815	10.	.96
3.5	.61	7.	.84		

In this table it will be necessary after having found the reluctance per unit length to divide this quantity by the entire length of the cylinder. This table is deduced from the formula

$$P = \frac{\cdot 737 \log_{10} \dfrac{a_1}{a_2}}{l}$$

$$\text{where } \frac{a_1}{a_2} = \frac{d}{b - \sqrt{b^2 - d^2}}$$

By the above calculation considerable insight may be gained regarding the leakage of a new type of frame. See table.

Alfred E. Wiener has ingeniously combined the results of many investigators and produced a table in the *Electrical Engineer*, in which the leakage value for a great number of machines is given.

Capacity in kilo watts	Factor of magnetic leakage, λ															Capacity in kilo watts
	1. Upright horseshoe type	2 Inverted horseshoe type	3 Horizontal horseshoe type	4 Single magnet type	5 Vertical double magnet type	6 Horizontal double magnet type	7 Bipolar iron clad type	8 Vertical double horseshoe type	9 Horizontal double horseshoe type	10 Fourpolar iron clad type	11 Single magnet multipolar type	12 Radial multipolar type	13 Inner-pole type	14 Tangential multipolar type	15 Axial multipolar type	
1	2·00	1·75	……	1·90	……	1·50	1·50	……	……	……	……	……	……	……	……	·1
·25	1·80	1·60	……	1·75	2·00	1·40	1·40	……	……	……	……	……	……	……	……	·25
·5	1·70	1·50	2·00	1·65	1·90	1·35	1·35	1·80	1·90	……	……	……	……	……	……	·5
1	1·65	1·45	1·90	1·60	1·80	1·30	1·30	1·70	1·75	……	……	……	……	……	……	1
2·5	1·60	1·40	1·80	1.55	1.70	1·28	1·28	1.60	1·65	1·75	1·60	1.50	1·40	1·90	2·00	2.5
5	1·55	1·35	1·75	1·50	1·65	1·25	1·25	1·55	1·60	1·65	1·50	1·40	1·35	1·80	1·90	5
7·5	1·50	1·30	1·70	1·45	1·60	1·22	1·22	1·50	1·55	1·60	1·45	1·35	1·32	1·70	1·80	7.5
10	1·45	1·28	1·65	1·40	1·55	1·20	1·20	1·45	1·50	1·55	1·40	1·82	1·30	1·65	1·70	10
25	1·40	1·25	1·60	1·35	1·50	1·18	1·18	1·40	1·45	1·50	1·35	1·80	1·28	1·60	1·65	25
50	1·35	1·22	1·55	1·32	1·45	1·15	1·15	1·35	1·40	1·45	1·30	1·28	1·25	1·55	1·60	50
100	1·30	1·20	1·50	1·30	1·40	1·12	1.12	1·30	1·35	1·40	1·25	1·25	1·22	1·50	1·55	100
200	1·25	……	……	……	……	……	……	……	……	1·33	1·22	1·22	1·20	1·45	1.50	200
300	1·20	……	……	……	……	……	……	……	……	1·35	1·20	1·20	1·18	1·40	1·45	300
500	……	……	……	……	……	……	……	……	……	……	……	1·18	1·15	1·35	1·40	500
1000	……	……	……	……	……	……	……	……	……	……	……	1·16	1·12	1·30	1·35	1000
2000	……	……	……	……	……	……	……	……	……	……	……	1·15	1·10	1·25	1·30	2000

TABLE OF LEAKAGE FACTORS FOR VARIOUS TYPES AND SIZES OF DYNAMOS.

The principle, it seems, that should be greatly observed in the design of frames is to use pole-piece and core as one, and have them as nearly in line as possible, so that if leakage does occur it is included under the second class of conditions—leakage between surfaces in the same plane.

Machines with radial poles and a common keeper or a horseshoe type such as previously described, with the two cores diverging, should not have very great leakage, because with a varying magneto motive force we have in such cases a correspondingly increasing distance.

(*To be Continued.*)

STRIKE ON THE BROOKLYN TROLLEY LINES.

The differences between the Brooklyn Electric Railroad companies and their employés culminated early on the morning of January 14, when the men struck. It is estimated that 6,000 employés of the various roads are involved in the big strike.

On Sunday night, District Assembly 75, K. of L., considered the situation, and after two hours' deliberation it was voted to strike. The last of the long series of conferences was held between President D. F. Lewis, of Brooklyn Heights Company, and the Executive Committee of District Assembly 75, on Saturday night, but it was unsatisfactory and left nothing to hope for in regard to effecting a settlement of the differences.

The men charge Mr. Lewis with trying to break the power of their organization. They have been yielding to the roads point after point for years, they say, and now the companies ask them to surrender their main hold.

The police department had made preparations several days ago to act in case of a break between the contending forces, and nothing will be left undone to prevent lawlessness and undue interference with the companies' efforts to re-establish the service.

THE WASHINGTON AND BALTIMORE ELECTRIC RAILWAY.

The *Manufacturer's Record* of Baltimore is authority for the statement that the contracts for completing the Washington and Baltimore electric road will be all given out by April 1, and that the line will be in operation between the cities named before the end of this year.

At present the enterprise is in charge of two companies—the Washington and Baltimore Boulevard Co., of which David M. Newbold of Baltimore, is president, and the Edmondson Avenue, Catonsville and Ellicott City Co., in which Messrs. B. N. Baker and John Hubner, also of Baltimore, are the principals. The Newbold company has let the contract for grading fourteen miles of the Washington section, and the Edmondson Avenue Co. has signed a contract to complete about five miles of the Baltimore section, extending from Calverton, in the western suburbs, to Beaumont avenue, near Catonsville.

The distance from city limit to city limit is about twenty-seven and a half miles.

Arrangements will be made with the Baltimore Traction Co. to transfer passengers from the Baltimore terminus to any part of the city over its lines, and negotiations are already in progress to that end.

The road complete will cost about $1,000,000. It will be operated by the block signal system, and twenty 100 horse-power motors will cover the distance from city to city in about 35 minutes.

A site for one of the power houses has been purchased at the corner of Ingleside and Edmondson avenues. It is 400x200 feet, and will be one of the three to supply the electric current for the entire system.

Each station will be of 1,000 horse-power, and contain a series of dynamos of 500 volts each.

IN MEMORY OF MR. DEGENHARDT.—The Standard Underground Cable Company of Pittsburgh, Pa., has gotten out a memorial sheet as a mark of its appreciation of Mr. Frederick E. Degenhardt, the late manager of the western sales department at Chicago. The Standard Company is sending a copy of this mark of respect for its deceased representative to all of Mr. Degenhardt's friends and acquaintances, whose addresses can be obtained. Any one can procure a copy by applying to the Standard Underground Cable Company, Pittsburgh, Pa.

CONSTANT SPEED MOTORS.

BY THOS. J. FAY.

Shunt wound motors for continuous, constant potential currents, although very frequently termed "automatic motors," do not operate at a constant speed. Where accuracy is desired, motors of this class are said to be "practically constant" in speed when the speeds (in the case of a shunt wound machine) are as nearly constant as practice can make them. The reasons why they do not operate at a constant speed, assuming of course the potential is constant, are quite easy to determine if one will take the pains to plot a speed curve. The variations in speed of shunt wound motors are not so great as to seri-

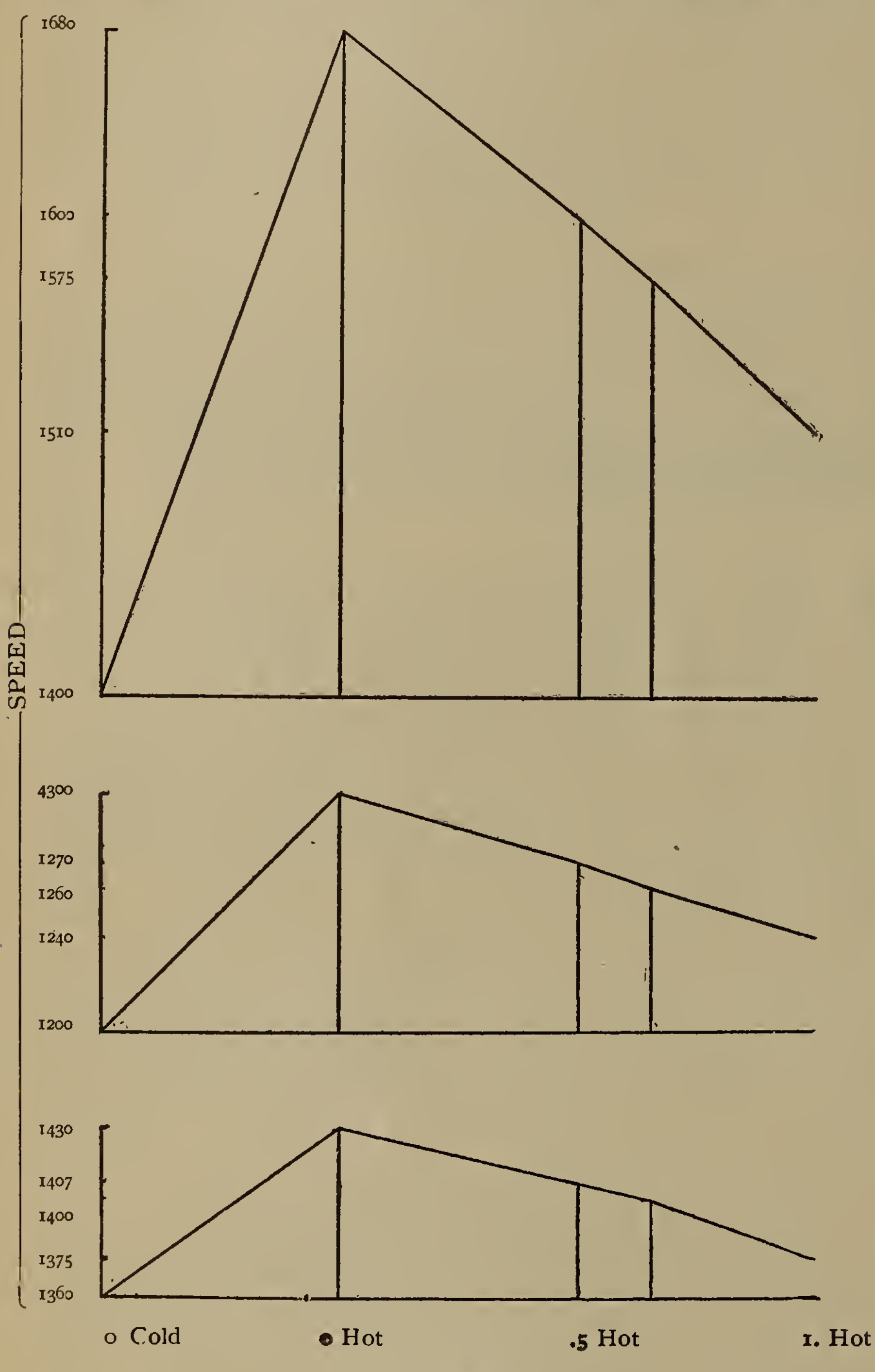


Fig. 1.—Speed Curve of 3 h. p. Shunt-wound, Constant Potential Motor.
Fig. 2.— " 5 h. p. " " " "
Fig. 3.— " 7½ h. p. " " " "

ously retard their application in any of the ordinary uses to which they may be put. In New York alone there is not far from 10,000 H. P. in shunt wound motors in daily operation. There are uses, however, for motors in which a constant speed is absolutely necessary; as for instance in silk mills and other establishments of a similar nature. Here we have a class of machinery which, unless operated at a constant speed, will play havoc with the product. The first time the writer tried to operate a silk mill by an electric motor he found, to the great annoyance of all concerned, that a variation in speed of four or five per cent. was quite out of the question. Another difficulty in this case was the wide range of fluctuation of the potential of the supply current (a railway circuit), which together with the inherent speed variations of the shunt wound motor used prevented the successful operation of the plant by this means. In other instances, however, by employing motors of considerable ratings and constructed so as to have a very close regulation, as far as is possible with shunt wound motors, he has succeeded in operating textile machinery successfully. It might be said that the shunt wound motor for such uses will be in all probability superseded by the compound wound motor, which, although not as efficient as the shunt wound machine, will operate at a "constant speed." This fact will be the governing condition, for the difference in efficiency is not great.

The reasons for speed variations in shunt wound motors are too well known, perhaps, to require much comment now. It may be, however, that some actual tests will interest the readers of the Electrical Age. The author has plotted curves for several sizes of motors, from which it will be readily observed that the greatest change is found in small motors, while motors of larger sizes act quite efficiently. The diagram (Fig. 1) was taken from a three H. P. motor, and shows a change in speed of 16.67 per cent. between o load cold and o load hot. This change is traceable directly to the resistance of the field coils in ohms hot, as compared with the resistance cold. As a matter of fact, the resistance of the coils increases .21 per cent. for each degree F. increase in temperature, and the potential being constant the current in amperes decreases in the coils as the resistance in ohms increases. The

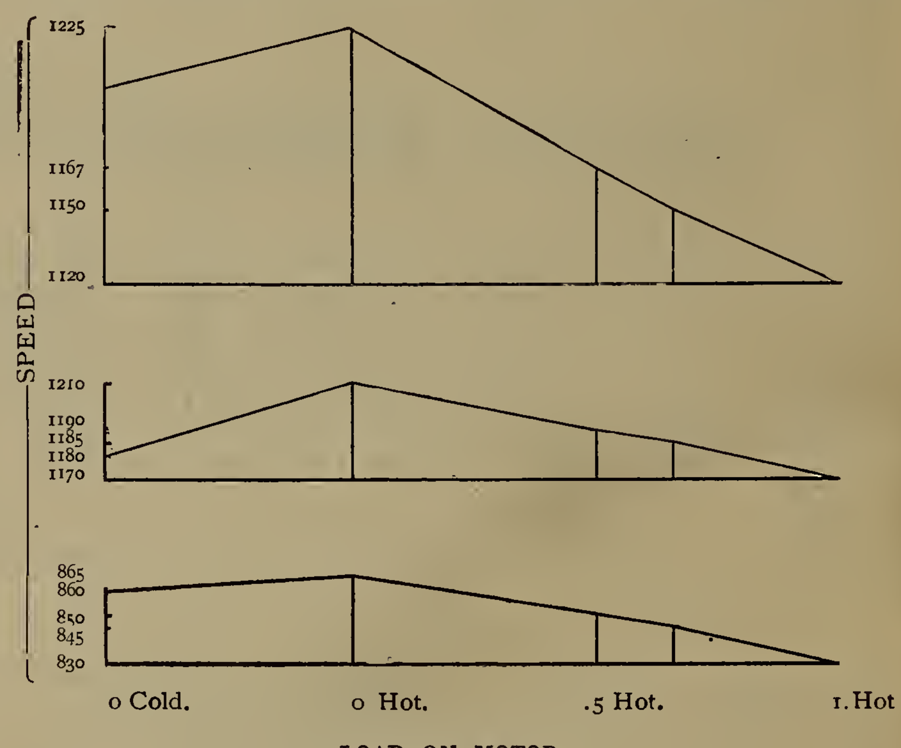


Fig. 4.—Speed Curve of 10 h. p., Shunt-wound, Constant Potential Motor.
Fig. 5.— " " 15 h. p., " " " "
Fig. 6.— " " 20 h. p., " " " "

result of this is the M. M. F. in gilberts decreases, thereby changing the counter E. M. F. in volts of the motor, unless the speed increases sufficiently to compensate for the decrease M. M. F. in gilberts. The curve shows that the speed changes, and a further change is noted after the condition known as "hot"—that is, when the maximum increase in temperature has been reached. This change cannot be caused by any temperature conditions in the field; we therefore look for the cause in the armature. The curve shows that between o load hot and full load hot the speed lowered 10 per cent., during which time the current in amperes in the armature increased, while the speed decreased. Inasmuch as the E. M. F. in volts at the motor terminals was constant, as also the M. M. F. in gilberts of the field, it is self-evident that the counter E. M. F. in volts of the armature decreased as the current in amperes increased. The decrease can thus be accounted for, and is due to the resistance in ohms of the armature. In any conductor through which a current is said to flow there is a fall of potential which, in this case, lowers the impressed E. M. F. in volts in the armature, and in doing so also lowers the angular velocity in revolutions per minute. In view of the foregoing facts we might say for shunt wound motors in general, that the fields should be so proportioned as not to heat very much above the temperature of the surrounding air, then the change in

speed between o load hot and o load cold would be at a minimum, and further, that the resistance in ohms of the armature should be as low as possible in order that speed variations under working conditions shall be a minimum. In reality, during the greater part of a day's run motors are in the state known as "hot" and the change in speed due to a change in the M. M. F. in gilberts is only in evidence the first part of a day's work. As more conclusive evidence that the armature resistances are prime causes of speed changes in shunt wound motors we have but to inspect the curves taken from the larger sizes of motors. It will be seen that the commercial efficiency increases in each motor over the other as the sizes increase. This shows that the C^2R losses in the armature decrease in one armature below the next smaller, per horse-power, which means that the resistance in ohms decreases in the machines as the sizes increase. We note also in Fig. 2 the result on the speed changes. This is a curve of a five H. P. motor, in which the speed change is 4.7 per cent., the machine running hot. The curve for a three H. P. motor (Fig. 1) shows a speed change of 10 per cent. with the motor running at maximum heat.

Fig. 3 gives a curve of a 7½ h. p. motor, which shows a change in speed of 3.9 per cent., between o load hot and full load hot. Fig. 4 is a curve of a 10 h. p. motor, showing a result not quite in accord with the heretofore gradual reduction of the speed variation. It indicates that the armature resistance is comparatively high; the change is 8.6 per cent., between o load hot and full load hot. The curve (Fig. 5), however, shows a better result, for the speed change between o load hot and full load hot is but 3.3 per cent, while the curve, Fig. 6, shows a motor of a still larger size, in which the speed change is 4.1 per cent., indicating the fact that the C^2R loss at full load is a little higher proportionately.

A summary of the speed changes in these several motors for the sake of easy comparison might not be out of place here.

SUMMARY.

Rated h. p. of motors.	Change in speed from o to full load hot.
3	10 per cent.
5	4.7 "
7½	3.9 "
10	8.6 "
15	3.3 "
20	4.1 "

(Note.—The brushes were in a fixed relation at a point, zero minus.)

Regarding the question of changes in speed of motors in general, it might be said that the tests referred to show about the average results. Some machines have been found to do better, while others acted badly, due largely to attempting to wind for low initial speeds, with comparatively weak magnetic fields.

ELECTRICAL NEWS FROM JAPAN.

BY S. KATOGI.

The Tokyo Telephone Exchange has now a total of 1800 subscribers, and is constructing lines and installing instruments for about 2,000 more.

Mr. K. Sawai, chief of the exchange, who spent some time in America familiarizing himself with the telephone service in that country, died on November 28, of consumption. Mr. Sawai was 30 years of age, and unmarried. Many American electricians knew Mr. Sawai well and will regret to learn of his death at so early an age. The development of the telephone in Japan was largely due to his efforts and enterprise.

The Kyoto electric railway, which is being constructed between Kyoto city and Fushimi, is nearly completed and ready for operation. The road is 7½ miles in length. It is built on the overhead trolley system. Some of the cars, trucks, motors, etc., were manufactured in Tokyo city. The wheels, springs and rails, however, are of foreign make. The manufacture of these equipments in Japan shows how we are progressing in this country in the matter of industrial development. The motors above referred to are 25 h. p. each.

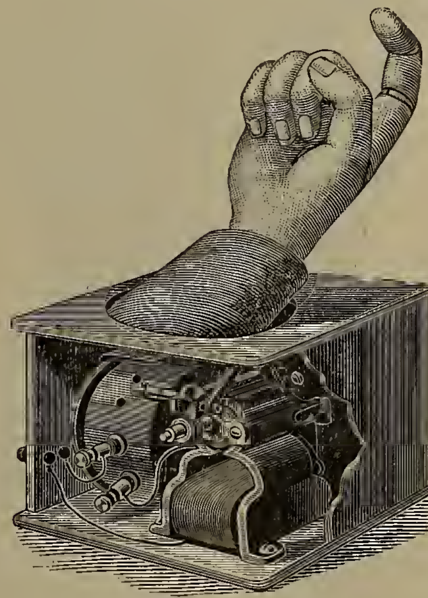
In Tokyo we have an electrical journal, named "The Electrical Friend." It is the only general electrical paper published in Japan, and represents the electrical industries of this country. It is published monthly by S. Katogi.

The war between this country and China somewhat disturbs general industry in this country, but everything looks favorable for the future.

Tokyo, December 20, 1894.

HAWES' BECKONING FINGER.

An ingenious device for attracting attention to displays of goods, etc., in show windows or show-cases, is shown in the accompanying illustration. It consists of a mechanical hand placed upon a box. The index finger is jointed, and through the means of proper mechanism it bends forward and backward, perfectly reproducing the well-known beckoning motion. The first view of the finger inviting the people to come in is startling, the motions are so life-like.



HAWES' MECHANICAL HAND.

It is an excellent advertising device. The device is operated by an electric motor contained within the box, or it may be worked by other forms of power with the mechanism independent of the box if desired.

Mr. H. E Hawes, 393 Pearl street, New York city, is the manufacturer of this novelty. The hand can be made in any size—as big as a house if necessary—and it can be placed in any position in the window or case.

Our illustration shows the electrical operating mechanism very clearly. This device should find a large field of application.

Mr. Hawes makes advertising devices of all kinds, both mechanical and electrical.

ELECTRICITY ON THE N. Y., N. H. & H. R. R.

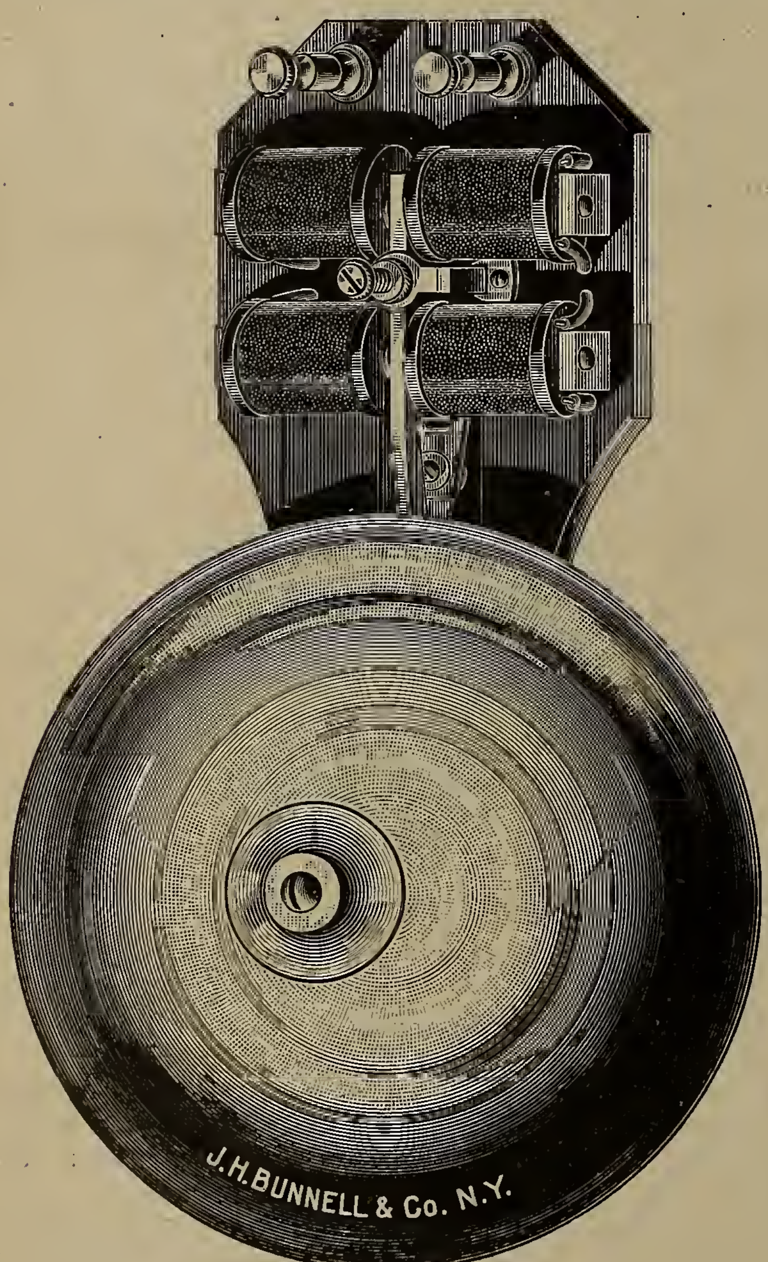
It is reported that the New York, New Haven and Hartford Railroad Co. is about to introduce electricity as a motive power on one of its branch roads. President Clark of the road, it is said, has selected the short line running from Pemberton, near Boston, to Nantasket Beach on which the experiment will be tried. It is the intention to have the road in operation in the spring, when the season opens. President Clark, however, says that nothing definite has been settled as regards the equipment, motors, cars, etc He says the object of the experiment is to solve a problem in economy, by means of a practical demonstration, and to prove whether or not it is more economical

to use electric power than steam for the operation of trains. If the experiment proves successful, President Clark says the use of electricity may be extended to other branches of the road and may eventually be introduced throughout the entire system.

NEW POWER VIBRATING GONG.

The gong shown in the accompanying illustration, on account of its power and loud alarm, is especially fitted for use at railway crossings, in yards and stations, hotels, and for fire alarms. school calls, etc. It is double acting, and is said to be the loudest and most powerful vibrating electric bell ever produced. Its action will be readily understood by reference to the smaller illustration, which gives an outline view of the design of the bell.

This bell differs in its construction from all others in that it



BUNNELL'S POWER VIBRATING GONG.

has no springs that require attention and readjustment, and in the arrangement and action of the hammer. The hammer is withdrawn in its forward stroke by an extra pair of magnets, which are energized by the full power of the current. These give a strong rebound to start and assist the forward stroke, which is then made with the added full force of the current by a separate pair of magnets. The hammer moves twice as far and is about three times as heavy as in the old form of bells. It does not have to overcome the force of a spring in its forward stroke, but is helped, instead, by a powerful recoil from the backward movement. The result is that with equal amount of battery, the power of the actual blow delivered on the gong is fully treble as compared with the similar action of old style bells.

This valuable improvement is the invention of Messrs. J. H. Bunnell & Co., the well-known electrical supply manufacturers and dealers, 76 Cortlandt street, New York city, and it is so simple that no one can help wondering why it had not been thought of before.

This bell will, no doubt, find a large field of usefulness wherever a loud sounding gong is needed, and it has the additional advantage of being so simple in construction that there is practically nothing to get out of order, and no points to stick and cause trouble.

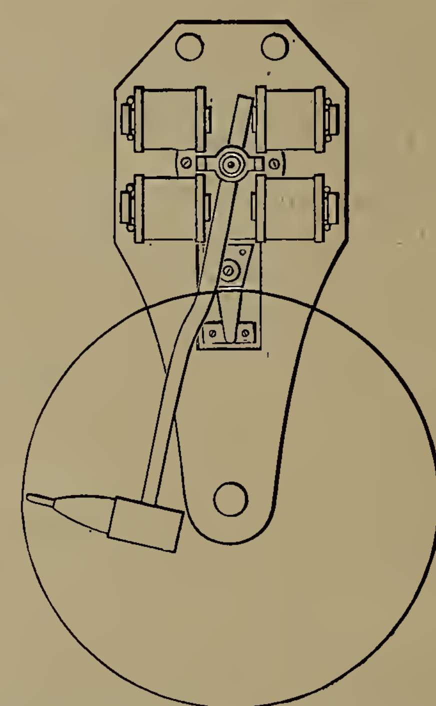
ELECTRO-PLATING HULLS OF IRON VESSELS.

An interesting test of a process of electro-plating the hull of an iron vessel was recently made in Jersey City, N. J.

The object of this plating is to preserve the portion of the hull under water from corrosion, and to prevent the formation of barnacles, which seriously impede the vessel's progress when in motion.

The experiment was made on an iron ocean tug. The boat was taken from the water last October and placed in the dry dock at the foot of Warren street, Jersey City. When taken from the water she was found to be badly corroded below the water line, and her hull covered with incrustations.

A government inspector who saw the boat as she came out of the water, remarked, "Well, if you can electro-



OUTLINE VIEW OF VIBRATING BELL.

plate that hull, you can electro-plate anything that floats."

The process of electro-plating is comparatively simple. It consists in applying to the side of the vessel tanks or baths, about five feet square. These are scribed out on the edges to conform with the curvature of the vessel's sides, and then firmly braced and shored in position. These baths or tanks are only about eighteen inches in depth at their greatest depth and this distance is cut down at each successive application.

The method is a triple one. The bath once securely placed in position and shored up is calked around the edges with cotton and oakum till it is water-tight and then it is filled with a strong acid solution that is allowed to remain in position for twenty-four hours. The effect of this is to clean the vessel's side perfectly and leave the surface of the iron plates ready for the next process.

The bath is then removed, the spot washed and cleansed and the bath replaced in readiness for the second step. It is now filled with a solution of cyanide of copper and the electric current turned on. The current is one of only six volts, but of about nine hundred amperes. The effect of the cyanide solution is a two-fold one. It completes more perfectly the cleansing of the side of the vessel, and in addition acts as a sort of a flux, and in this way causes the

film of copper that is next to be deposited to be firmly adherent. This bath is allowed to remain in position for twenty-four hours, when the final stage is reached. The cyanide solution is drawn off and one of sulphate of copper takes its place. Large plates of copper are suspended in the bath, and these are connected with the positive pole of the dynamo, while the negative one is attached to the side of the ship. Immediately the deposition of copper begins. The current used is nearly the same as that for the cyanide solution, except that it is reduced from six to three volts, while the amperage is kept as before at about nine hundred. Four days are used in this part of the process, and when at last the current is stopped and the bath removed, the entire side of the vessel inside of the limits of the bath is found to have been thoroughly and evenly coated with copper to the thickness of about one-sixteenth of an inch. The coating is closely adherent and cannot be removed except by a cold chisel, and in that case part of the iron comes along with it.

This is the process that is repeated all over the sides of the vessel. Each new position of the bath is arranged so that it will lap a little over the edges of the section already done, and the result is, that when the entire work is finished the vessel is copper-plated all over to the thickness of one-sixteenth of an inch. There is no crack where water could get in, no seams or joints, and in no possible way is there any chance for galvanic action to set in except by such a blow or grinding on a rock as would cut through the copper film and into the iron beneath. It is needless to say that after such a blow the vessel would have to be put into a dry dock in any event, and when there a small bath applied to the spot would in a few days entirely remedy the difficulty.

The plating has been watched with liveliest interest by the government inspectors, who have visited the tug almost daily, and who have tested the work in every possible way. Each section as fast as finished has been subjected to the searching tests of the cold chisel and hammer and no flaws have been found. The opinion of these experts has been and still is that the process is a thoroughly practicable and effective one. Another incidental benefit is the prevention of barnacling, copper being well known to be the only metal to which barnacles will not adhere.

This corrosion and barnacling of war vessels in particular has been such a serious evil that at present it has been found necessary to adopt the most cumbrous means to prevent it. Modern war vessels have outside of their hulls a two-inch sheathing of plank fastened on by iron bolts. Outside of this a second two inch sheating of planks, held on by copper bolts, and to this exterior sheating the copper plates are nailed in the usual way. Even with all these precautions the barnacles attach themselves at the cracks and seams, and from the bottoms of two of our vessels, the Alert and Atlanta, were taken at one time the enormous amount of 25 tons of barnacles and incrustations.

The great ocean liners have to be placed in the dry docks, their bottoms cleaned and painted, at the end of every two round trips. Some idea of the saving in cost may be gained by the statement that Philip Hichborn, the United States Naval Constructor, in his report to Congress states that to dry-dock, clean and paint the cruiser Chicago at any port would cost about $12,000, and that it is on the average necessary to do this three times a year, making the enormous cost of over $100,000 for a three years' cruise for this item alone.

THE CLEVELAND CONVENTION OF THE N. E. L A.

Mr. George F. Porter, Secretary of the National Electric Light Association, writes us—:

"The indications are that the attendance at the Cleveland meeting will be very large, and quite a number of delegates intend taking their wives.

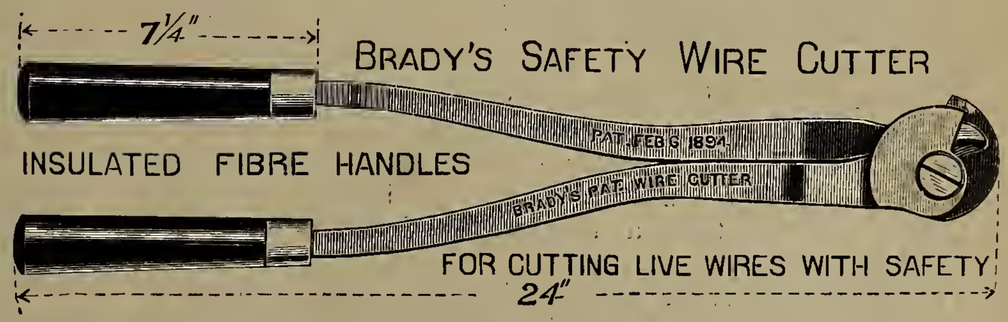
"Hotel accommodations should be reserved early to insure comfortable quarters. The headquarters will be at the Hollenden Hotel, the rates being: American plan, $3 to $5 per day; European, $1 to $3 per day.

Other hotels in close proximity to the Hollenden are: The Weddell, $3 to $5 per day; The Stillman, $3 to $5 per day; Forest City, $2 to $3 per day; Kennard, $2 to $3 per day; American, $2 per day.

SAFETY WIRE CUTTERS.

The accompanying illustration shows the Brady safety wire cutter with insulated handles. This device is intended for use in cutting line wires and cables, and on account of the insulated handles the operation can be performed with perfect safety.

The total length of the cutter is two feet, the handles being 7½ inches in length, giving a large margin of safety in handling. The insulating material is vulcanized fibre.



SAFETY WIRE CUTTERS.

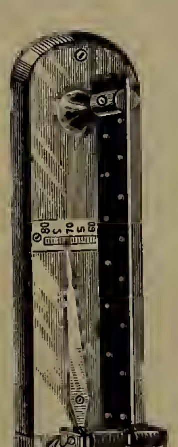
The cutter is made of steel drop forgings, and the blades are of the best dropped forged tool steel.

The cutter blades are so arranged that as they are ground away in sharpening they can be set around one notch at a time, and this can be repeated until the blade is entirely used up, when a new set of blades can be inserted.

These cutters are finished in nickel, antique bronze and forge finish, and are manufactured by James Brady, 83 Washington street, Brooklyn, N. Y.

THE COMPTON TEMPERATURE REGULATING SYSTEM.

The Compton Electric Service Company, Postal Telegraph Building, New York city, is having a satisfactory demand for its temperature regulating service. The system is in operation in the committee rooms of the United States House of Representatives and Senate in Washington. The temperature alarm is connected to the magnet thermostats in the House of Representatives. Mr. Thurber, President Cleveland's private secretary, has the system in operation in his private residence. The parochial residence of the St. Aloysius Church, Washington, D. C, is also installed with the system.



Many of the most prominent residents of Washington are becoming interested in the system and its advantages, and others have had the apparatus installed in their homes. In Baltimore, also, the Compton system is finding a large field, many of the most prominent institutions of that city having had it installed.

The Compton Electric Service System was fully described in the ELECTRICAL AGE of November 17, 1894. It provides means for automatically controlling the temperature of rooms, halls, theatres, etc., without personal attention. Any desired temperature can be maintained within a range of two degrees variation. By the use of this system economy of fuel is effected and comfort and health conduced.

REPORT OF THE THERMITE SYSTEM OF SANITATION.

The report of a scientific and technical commission, composed of eminent sanitarians, chemists, and engineers, appointed by the municipal council of Havre to investigate the Hermite system, has just been given publicity. This commission, after prolonged experiments made at Havre on an elaborate scale, has formulated the following conclusions :

(1) That electrolyzed sea water is a powerful antiseptic and germicide.

(2) That the activity of the agent is in proportion to the quantity of chlorine, that is to say, an equal weight of chlorine acts more energetically and efficaciously in 10 liters of water than in 20 liters, and in 5 liters than in 10.

(3) That the disinfecting action of the liquid is not instantaneous, but continuous as long as there is an excess of chlorine remaining.

(4) That five grams of active chlorine will, with sufficient time, completely disinfect the excreta of a normal "stool" or dejection, and after two hours of contact all pathogenic germs will be destroyed and disappear.

The commission does not hesitate to declare the great value of M. Hermite's process of sanitation by electrolyzed sea water under the following conditions :

(1) That, to act efficiently on the material to be disinfected, the electrolyzed water must be in sufficient quantity, and contain a minimum of five-tenths of a gram of free chlorine per liter.

(2) That the excreta must be kept in contact with the liquid, in the siphon of the closet or other receptacle, a sufficient length of time to insure the antiseptic action of the liquid before being discharged into the gutter or sewer.

From a financial point of view, the commission declares that the results obtained during the experiments with the Hermite system in the quarter St. François at Havre show that, while the system gave excellent results from a sanitary standpoint, it can not be considered an economical system, but requires further study and improvement before it can be recommended as applicable to large cities. Some doubt, moreover, is expressed as to whether a chlorine liquid of the kind can be applied freely to dwellings without producing disagreeable, if not unwholesome, effects and without destructive corrosion of metal pipes. The chlorine gas, it is believed, will pervade the house to a greater or less extent, imparting its disagreeable odor to articles of food with which it may come into contact and irritating the lungs of the occupants of the dwelling.

But, in spite of the several objections which have been urged against the system, it is believed by many who have witnessed its application at Havre and other cities of France, that M. Hermite is engaged in an enterprise of great pith and moment, and that electricity may yet be made as useful to man as a shield against death by preventible disease as it has already proved itself a priceless servant as a messenger and an illuminant. Certain it is, the last word has not been spoken in favor of treating sewage by electrolysis.

ANNIVERSARY OF FRANKLIN'S BIRTH.

The Franklin Electrical Society, of New York city, will celebrate the 189th anniversary of the birth of Benjamin Franklin on January 19. The regular meeting of the society will be held on that date at the Cafe Logeling, on 57th street, after which a banquet will be held in honor of the event above referred to. Franklin was born January 17, 1706.

This society meets on the second and fourth Saturdays of every month. At the last meeting Prof. W. W. Ker read a paper on "Boilers and Engines for Electric Lighting."

The officers are making efforts to increase the membership of this worthy organization. Mr. Maxwell M. Mayer is the president. Applications for membership sent to the Cafe Logeling will receive the proper attention.

PERSONAL.

Messrs. W. J. Morrison and J. J. Wood, of the Fort Wayne Electric Corporation, Fort Wayne, Ind., were in New York this week.

Mr. J. H. Allen, chairman of the Committee on Machinery, Atlanta Exposition, Atlanta, Ga., is in the city in the interests of that great enterprise.

THE ARC LIGHT REGULATOR NOW PUBLIC PROPERTY.

On January 14 a decision was rendered in Chicago in the suit of the General Electric Co. vs. the Western Electric Co. regarding the arc light regulator, the court deciding the case in favor of the defendant company. This decision was made on the ground that Elihu Thomson invented an arc light regulator but never patented it. Thomson took out a patent on a spark arrester which device was used as a regulator for two years and then discarded as such.

This suit was begun about six years ago, and its decision makes the arc lamp regulator public property.

APPEAL FROM THE BERLINER DECISION.

The Bell Telephone Company has appealed from the recent decision of Judge Carpenter, in Boston, in the Berliner case. The appeal was taken to the United States Circuit Court of Appeals. Among the errors set forth are that the court should have dismissed the bill in equity which was brought by the United States; that the court should have found that the Berliner patent was for a different invention from any that was patented; that the court should have found that the Bell Telephone Company always intended and always did prosecute its application for the patent in suit with diligence, and with intent and purpose to secure the issue of the patent at the earliest practicable day.

A Large Number.—The *Tradesman Annual* for 1895, published in Chattanooga, Tenn., is one of the most extensive trade publications that we have ever seen. It has no less than 218 pages, and is full of matter interesting to every industry. The *Tradesman* is the leading industrial paper published in the South.

Judgment.—Judgment for $15,444 was entered on January 15 against John F. Zebley, of New York City, in favor of Henry J. Miller and E. J. Hathorne, as receivers of the Fort Wayne Electric Company, of Fort Wayne, Ind., on four notes.

BUSINESS REVERSES.

It is reported that the Portland Consolidated Street Railway Company, Portland, Ore., has gone into the hands of a receiver. The company operates over 20 miles of line and its property is said to be valued at between one and one-half and two million dollars.

The Fond du Lac Railway Company's plant, Fond du Lac, Wis., has been sold by the sheriff to satisfy liens held by various creditors. It is reported that the purchaser was Elihu Colman.

The Electric Railway Company, Savannah, Ga., went into the hands of a receiver on January 8, Mr. John R. Young being as such appointed by the United States court, on the petition of H. A. Pevear, of Lynn, Mass. The petition alleges that over $1,000,000 worth of stock has been issued by the company without the return of a fair valuation. It is also charged that certain parties interested in the company ran it to build up the value of lots regardless as to whether it was solvent or not. The value of the property in the receiver's hands is placed at one-half a million dollars. The company operates thirty-miles of line.

THE NATURE OF A CAVEAT.

There is considerable misconception as to the nature of a caveat—what its object is, and what rights it affords an inventor. This subject was considered by Mr. Horace Pettit, in his lecture on "The Law of Invention," before the Franklin Institute, Philadelphia, last November, and we produce this portion of his remarks for the enlightenment of those of our readers whose knowledge regarding the caveat may be indefinite. We quote Mr. Pettit's language :

"If an inventor has conceived but only partially completed his invention, and is apprehensive that before he shall complete the same another may file an application for letters-patent for the same invention, what is he to do? The law provides him a remedy. He can file what is termed a 'caveat.'"

"A great many inventors, principally the inexperienced, of which there are a great number—have acquired the idea from some source that a caveat is a *cheap patent*. This is not the fact. A caveat is for *one* purpose, viz., *notice*. It gives no right to the caveator to prevent others from making, selling or using his invention, during the life of the caveat, or at any other time, until he has secured and has actually issued to him letters-patent. The law relative to caveats merely says to the inventor, substantially : If you desire further time to *mature* your invention you can file a caveat in the Patent Office, and if an application for a like invention is made during the life of the caveat, you will receive notice of the same, whereupon you must file your application within a limited period specified.

"Section 4,902 of the Revised Statutes says, substantially, that any citizen (or alien, if he has resided one year in the United States next preceding the date of filing, and has declared his intentions to become a citizen of the United States), who desires further time to *mature* his invention or discovery may, upon payment of the fees, file a caveat setting forth the design and characteristics of his invention, and praying protection until he may have matured his invention, which caveat will be filed in the confidential archives of the Patent Office, A caveat is granted for *one* year, from the date of filing, but may be renewed from year to year at the will of the caveator. If an application is filed for the same invention during the life of the caveat, notice is given to the caveator and he must file his application for a patent in three months from the time allowed for receipt of same by mail. If the claims are for the same invention an interference will be declared, and the case will be heard as on the usual interference proceedings in the Patent Office.

"Cases have arisen where it has been shown by proof that the inventor did not receive the notice sent him by mail, and it has been held that as it was no fault of the caveator that he did not receive the notice he should not suffer, but that he was entitled to contest in the Patent Office the priority of his invention over the claims of the man who secured the patent, and if he should sustain his claims to priority he would be entitled to a patent. (Frevert *vs.* Gahr, 1873, 3 *Official Gazette*, 660). This was also substantially held in Ware *vs.* Bullock (1874), 7 *Official Gazette*, 39), Phelps, *vs.* Brown (1859), 4th Blatch., 352.

"The rule in reference to caveats applies only to notice of application which are filed while the caveat is alive. Of those filed before the caveat and after it has expired by limitation, the caveator is not entitled to notice."

BUSINESS OF THE PECKHAM MOTOR TRUCK & WHEEL COMPANY.

The Peckham Motor Truck & Wheel Company's business during 1894 showed a decided increase over that of the preceding year. The company found no difficulty in running its works at full capacity during the entire year, showing the increasing demand for Peckham trucks as they become better known by street railway companies. More than 2,000 of the Peckham trucks are now in use on the cable and electric roads in New York city, Brooklyn, Jersey City, Hoboken and Philadelphia, where they have been adopted as standard after a thorough trial. Among these ten roads on which the Peckham trucks have been adopted as standard may be mentioned the Atlantic Avenue road in Brooklyn, the Consolidated Traction Company's lines in Jersey City, the People's Traction lines in Philadelphia, and the Metropolitan Street Railway Company's lines in New York city.

The Peckham Company has brought out during the year its new "Excelsior" trucks, including the "Trailer" truck, designed especially for trailer cars; the "Spiral Spring" extension truck, designed for 16-foot closed or 26-foot open cars; the "Elliptic Spring" extension truck, designed for the same size cars as the "Spiral Spring" truck, and also its No. 10 "Swivel' truck for long cars.

The chief feature of the company's work during the past year, however, has been the care given to the small details of construction

Many improvements have been made where the varying requirements of street railway service indicated that changes or improvements were desirable. The main design of the Peckham truck has not been changed, as this has been found to be entirely satisfactory.

During the year 1895 other new features will be added where they may be found to be desirable; and judging from the present prospects the Peckham truck will be adopted during the year by a large number of electric railways as their standard.

IMPROVEMENT IN PRIMARY BATTERIES.

EDITOR ELECTRICAL AGE :—Continual inquiry being made for improved primary batteries and, if any there be, what degree of improvement has been attained. We ask the privilege of informing any who may be interested to the following statements, which may be relied upon as strictly true.

The degree of improvement can best be shown by comparing what has been claimed and advertised as the best primary battery for two or three years past, with a new battery recently perfected and fully tested.

We have before us an illustrated catalogue and price list of the former battery, which makes the following claims as to construction, efficiency and economy, which are doubtless correct.

Dimensions are as follows :

Size 7x7x9 in depth; weight 22 pounds; capacity 90 ampere-hours; E. M. F., 2 volts; Constant E. M. F. at discharge of 1 ampere; cost of charge per cell, 45 cents.

Dimensions of the new battery are as follows :

Size 4x7x8 in depth; weight 14 pounds; capacity 100 ampere-hours; E. M. F., 2 volts; constant E. M. F. at discharge of 3 amperes; cost of charge per cell, 5 cents.

Attention is called to the greatly reduced cost of maintenance which, with the greatly improved apparatus, both in weight and convenience of managing, certainly constitute a long step in advance of anything yet offered to the public in the line of primary batteries for uses requiring strong and constant current.

To practical men who are operating ventilating fans we say, a 10-inch fan can be given a high speed at a cost of *one cent per day* with this battery.

To electricians and especially battery experts we will say—here is a battery that will not polarize at any rate of discharge or when placed in absolute short circuit. "The less the polarization the better the batteries," says the highest French authority (Niaudet, page 46). It follows, therefore, that "freedom from polarization is the perfect battery;" does it not?

We selected two batteries for comparison because of their rated capacity being nearly the same; other sizes are made by both parties.

No injustice is done to the battery selected, as all statements concerning it are taken from the makers' own catalogue. What is claimed for the new battery are results obtained by trials by as competent experts as the city of New York can furnish and also by actual use.

NEW YORK, January 2, 1895. W. H. O.

Possible Contracts.

The Queen City Electric Light Co., Gadsden, Ala., contemplates enlarging its plant.

C. W. Miller, Van Buren, Ark., is interested in a proposed electric light plant in that place.

The Mayor of Raleigh, N. C., can give information regarding the proposed purchase of an electric light plant, for which $25,000 bonds are to be issued.

The Anderson Electric Light and Power Co., Anderson, S. C., intends to increase its facilities, and will move its plant to a larger building.

An electric railway is to be built from Merced to the Yosemite Valley, Cal. The power for the same will be derived from the Merced River at three different points.

W. A. Mallory and Lamar Pyndon have leased the Athens Gas and Electric Light Works, Athens, Ga., and will improve the plant.

F. H. Jeannin, St. Louis, Mo , will establish an electric light plant in Arcadia, Fla.

E. Hughes, of Bismarck, Dakota, is interested in a scheme to establish an electric light plant in Dickinson, N. D.

Marsh & Jackson, Baraboo, Wis., are interested in a project to build an electric road at Devil's Lake.

Application has been made for a franchise to construct an electric railroad along certain avenues in Atlantic City, N. J. Among those interested are Congressman John Gardner, ex-postmaster Levi Albertson, Judge Jas. Thompson and I. G. Adams & Co.

The Ballard Electric Light Company's plant in Ballard, Wash., has been purchased conditionally by the city.

There is some talk of establishing an electric light plant in Blackstone, Mass., by the city.

J. H. Allen, of the machinery committee of the Atlanta Exposition, can give information regarding the equipment of the electric light and power plant in the building of the exposition. The plants are to be contracted for at once and an electrical and mechanical engineer is to be employed.

John P. Martin, of Xenia, Ohio, is interested in the construction of an electric light plant and water-works system, also an electric railway in Mount Sterling, Ky. A water-power is to be developed in connection with the enterprise.

P. J. Chappius, Mayor of Crowley, La., can give information regarding the proposition by the city to build an electric light plant and water-works.

Electric light plant and water-works are to be established in White Castle, La. Mayor G. M. Bowie can give further facts.

There is talk in Hamilton, Mo., of establishing an electric light plant in that place.

An electric plant light is to be installed in Oregon, Mo. For further particulars address James Cummings, Mayor.

The Lockhart Electric Light Company, Lockhart, Tex., intends to put new engines and boilers in its plant.

Some business is possible with John R. Hearn, who has bid in the electric light plant at Palestine, Tex.

Buildings for various uses are to be constructed in the following named places, and electrical equipment will probably be needed by some or all of them, viz : opera house, Halletsville, Tex , by McKnight Bros ; hotel, Hot Springs, Ark., by the Hot Springs Inclined Railway Co., (address B. F. Small & Co., St. Louis, Mo., for further particulars,); Jacksonville, Fla., a building for the Women's Christian Temperance Union ; large freight depots, Louisville, Ky., by the Cleveland, Cincinnati, Chicago & St. Louis Railroad Company; office building, Memphis, Tenn., by the Southern Express Co.; school house, Orange, Tex., address the mayor of that place; city hall, Rockdale, Tex., address the mayor; school house, St. Louis, Mo., by J. Riechers & Son ; school building, St. Louis, Mo., by Kirchner & Kirchner ; hotel, Yoakum, Tex., by John Huth.

J. S. Adams, Asheville, S. C., can give information regarding the construction of the proposed Asheville & Biltmore electric road.

The Atlanta Electric Company, Atlanta, Ga., is surveying for the extension of its line to Lakewood.

Davis, Evans & Company, Baltimore, Md., have the contract for building five miles of road for the Edmondson avenue, Catonsville & Ellicott City Railroad Company. John Hubner and B. N. Baker are interested.

Efforts are being made to revive the project to build an electric road from Frederick, Md., to Middletown, Md., a distance of eight miles.

The Interstate Transportation Co., Vicksburg, Miss., will build a trolley line from its gravel pits to the Mississippi River.

D. F. Carll, chief engineer of the Washington & Georgetown Railroad Co., Washington, D. C., can give information regarding the proposition to extend the lines of that company.

Bernard R. Green, 145 E. Capitol street, Washington, D. C., can be addressed regarding proposals for dynamotors.

The New River Mineral Company, of Ivanhoe, Va., will receive bids for a dynamo, eight arc lamps, wire and fittings.

John P. Martin, Xenia, O., is in the market for electric light plant and equipment ; also a steam plant.

L. R. Benjamin, Jacksonville, Fla., wants an electric railroad equipment, including cars, generators and overhead work.

W. N. McAfee is the contractor for the erection of the Government building at the Atlanta Exposition.

The North Texas Baptist College will soon be built in Greenville, Tex., and an electric light plant may be needed.

The Corsicana Mutual Telephone Co., Corsicana, Tex., will need some telephone wire.

The Fitzsimmons Telephone Co., of Cincinnati, O., will establish an exchange at Charlottesville, Va.

There is talk of organizing a company in Petersburg, Va., to establish a new telephone system.

There is talk in Hamilton, Mo., of establishing an electric light plant.

Spencerville, O., is to build an electric light plant of its own.

A Chicago syndicate is investigating the property of the Decatur Electric Street Railway Company, Decatur, Ill., with a view to purchasing the same.

New Corporations.

Gerson Electrical Mfg. Co., Philadelphia, Pa., by Chas. Heritage and others. Capital stock, $50,000.

Foreign Electric Traction Co., Alexandria, Va., by Eppa Hunton and others. Capital stock, $1,000,000.

The California Electric Light and Power Co., California, Mo., by W. H. Wengel, J. P. Gray, F. W. Sarman and others. Capital stock, $6,000.

The Clear Creek Gold Mining and Water Power Co., Denver, Col., by New York, Philadelphia and Colorado capitalists. Henry Levis, of Philadelphia is president and representative of the Eastern capitalists. The Western men are Scott J. Anthony, vice-president, and others.

The Raleigh Electric Co., Fayetteville, N. C., by A. A. Thompson, F. H. Briggs and others.

The Southern Ohio Telephone and Telegraph Co., Hamilton, Ohio, W. H. Pfau and others. Capital stock, $35,000.

The Elyria, Oberlin and Wellington Electric Co., Elyria, Ohio, by W. B. Bedortha, Chas. Metcalf, W. P. Steel, A. H. Johnson and others. Capital stock, $100,000.

The Cushman United Telephone Co., Chicago, Ill., by I. M. Cushman, O. O. Leabhart and Joseph Barton. Capital stock, $20,000,000.

San Diego, Pacific & Eastern Railroad Co., San Diego, Cal., by H. L. Storey and others. Capital stock, $1,000,000.

The Watseka Automatic Telephone Co., Chicago, Ill., by W. H. Harry, H. Darlington and E. E. Wood. Capital stock, $10,000.

The American Telephone Co., Johnstown, Pa.. Capital stock, $15,000.

The Athens Electric Railway Co., Athens, Ga., by W. S. Holman and others. Capital stock, 50,000.

National Glass Company, Portland, Me., by R. T. Doland and C. H. Jenkins. Capital stock, $250,000.

Mt. Clemens & Lakeside Electric Street Railway & Dock Company, Mt. Clemens, Mich., by B. B. Coursin and others. Capital stock, $25,000.

Telephone Notes.

The Interstate Telephone Co., which was recently incorporated in Kansas City, Mo., is about ready to commence construction work. It is said that it has 300 subscribers to start with.

The Southern Ohio Telephone and Telegraph Co. has been organized in Hamilton, Ohio.

The Cushman United Telephone Co. has been incorporated in Chicago with a capital stock of $20,000,000.

The Watseka Automatic Telephone Company has been incorporated in Chicago with a capital stock of $10,000.

The American Telephone Co. has been incorporated in Johnstown, Pa., with a capital stock of $10,000.

New York Notes.

Office of the Electrical Age,
World Building, New York,
January 14, 1895.

Mr. Lewis O. Brewster, formerly manager of the New York office of Almon & Sergeant, agents for the Belknap Motor Company, Portland, Me., is now connected with the New York Insulated Wire Company, 15 Cortlandt street, New York.

Mr. Hawkins, manager of the New York office, 136 Liberty street, of the Electrical Engineering and Supply Company of Syracuse, N. Y., is meeting with a good trade He took charge of this department during the past year and is keeping his company busy day and night with orders.

J. Jones & Son, 67 Cortlandt street, manufacturers of electric light, railway and power supplies, are to be congratulated upon their excellent business record during the past year. They report having done four times as much business as during any previous year since they began, which was over fifteen years ago.

Russell R. Brown, M. E., who was for a number ot years with the Henry R. Worthington Pump Company, is now representing the Snow Steam Pump Works, 106 Liberty street, New York. Mr. Brown's long experience and practical knowledge make him a valuable addition to the company, and his influence, no doubt, will be of material value to its interests.

The Geo. L. Colgate Company, 136 Liberty street, are moving into their new and larger quarters in the new addition of the Electrical Exchange. They are well pleased with the increased business they have secured since they began over a year ago. The house is a popular one with the leading buyers in the trade, and their promptness in filling orders and general courtesy has secured for them a host of friends.

The winter meeting of the Magnetic Club, of New York City, will be held on January 30, at Jaeger's restaurant, Madison avenue and 59th street. An amendment to the constitution will be presented and voted upon, changing the figures representing the limit of membership from 150 to 200. The article as proposed will read: "Persons to the number of 200, over 21 years of age, of good moral character, who are or have been connected with electrical pursuits, may be admitted to membership." W. T. H.

Trade Notes.

The Philadelphia Electrical Equipment Company, Philadelphia, Pa., has been dissolved by mutual consent, Mr. Carl P. Young retiring from the firm. Mr. Jas. R. Rettew will continue the business under the name of the Philadelphia Electrical Equipment Company, at 816 Cherry street. Mr. Rettew will carry on a general electrical supply and repair business.

Metropolitan Electric Company, 186–188 Fifth avenue, Chicago, have recently been making some changes in their store and have put in some new counters and shelving, thus adding to its attractiveness and furnishing better facilities for the display of their increased line of goods.

WOVEN WIRE BRUSHES.

The Belknap Motor Co., of Portland, Maine, are the patentees and manufacturers of the best woven wire commutator brush on the market.

ELECTRICAL and STREET RAILWAY PATENTS

Issued January 1, 1895.

532,016. Electrically-Propelled Vehicle. Henry C. Baker and John R. Elberg, Kansas City, Mo. Filed Apr. 6, 1894.

532,057. Motor Suspension for Electric Street-Cars. Samuel Harris, Cleveland, Ohio. Filed May 19, 1894.

532,086. Fender for Cars. John E. McBride, New York, N. Y. Filed Feb. 20, 1894.

532,095. Electric-Arc Lamp. Amos W. Richardson, Patricroft, England. Filed Mar. 2, 1894.

532,101. Insulator for Electric Wires. Daniel M. Rothenberger, Lancaster, Pa., assignor of one-half to Charles A. Inglis, same place. Filed Apr. 4, 1894.

532,103. Electric-Lamp Support. Frank Schefold and James Nortney, New Albany, Ind. Filed Mar. 1, 1894.

532,113. Converter System for Electric Railways. George W. Swartz, Florence, Ala. Filed Oct. 12, 1893.

532,126. Supply System for Electric Railways. Albert G. Wheeler, Chicago, Ill., assignor to the Love Electric Traction Company, same place. Filed Jan. 21, 1893.

532,128. Storage-Battery. Theodore A. Willard, Norwalk, Ohio. Filed Jan. 5, 1894.

532,133. Trolley-Wire Clip. Johan M. Andersen, Boston, Mass., assignor of one-half to Albert Andersen, same place. Filed July 9, 1894.

532,157. Underground-Trolley Arm. Paul C. Just, Chicago, Ill., assignor to Albert G. Wheeler, same place. Filed Jan. 4, 1894.

532,160 Insulator. Myron D. Law, Washington, D. C., assignor to Albert G. Wheeler, Chicago, Ill. Filed Aug. 29, 1893.

532,161. Conductor. Myron D. Law, Washington, D. C., assignor to Albert G. Wheeler, Chicago, Ill. Filed Sept. 28, 1894.

532,163. Conduit Tramway. John C. Love, Philadelphia, Pa., assignor to the Love Electric Traction Company, Chicago, Ill. Filed Sept. 5, 1893.

532,164. Conductor Support. John C. Love, Chicago, Ill., assignor, by direct and mesne assignments, to the Love Electric Traction Company, same place. Filed May 9, 1894.

532,165. Conduit for Electric Railways. John C. Love, Chicago, Ill., assignor, by direct and mesne assignments, to the Love Electric Traction Company, same place. Filed May 9, 1894.

532,166. Tension Device for Electric Conductors. John C. Love, Chicago, Ill., assignor, by direct and mesne assignments, to the Love Electric Traction Company, same place. Filed May 9, 1894.

532,167. Electric-Railway Trolley. John C. Love, Chicago, Ill., assignor, by direct and mesne assignments, to the Love Electric Traction Company, same place. Filed May 9, 1894.

532,168. Trolley-Wire Clamp. John C. Love, Philadelphia, Pa., assignor to the Love Electric Traction Company, Chicago, Ill. Filed July 11, 1892. Renewed Oct. 13, 1894.

532,185. Conductor-Bond for Meeting Ends of Rails of Electric Railways. Peter Reith, Chicago, Ill, assignor of two-thirds to John McGeean and James McGeean. Filed June 14, 1894.

532,188. Electric Hair-Clipping Machine. Peter Shannon, Chicago, Ill. Filed Apr. 27, 1894.

532,195. Trolley-Support. Lucius T. Gibbs, Milwaukee, Wis. Filed July 28, 1893.

532,200. Trolley for Electric Railways. John C. Henry, Westfield, N J. Original application filed Sept. 27, 1889. Divided and this application filed Mar. 8, 1893.

532,260. Cross-Arm for Support of Electric Wires. Edward J. Bullock, Wallingford, Conn. Filed Nov. 19, 1894.

532,261. Conduit Electric Railway. Albert M. Burgher, Clay City, Ky. Filed Apr. 17, 1894.

532,291. Electric Burglar-Alarm. Horace M. Scholes and George M. Myers, Kansas City, Mo. Filed Apr. 17, 1894.

532,302. Closed Conduit for Electric Railways. Frank Windle, Philadelphia, Pa. Filed Mar. 18, 1894.

532,339. Life-Saving Apparatus for Street-Car Platforms. William H. Rodgers, Brooklyn, N. Y. Filed Aug. 6, 1894.

532,353. Lightning-Arrester. Alexander J. Wurtz, Pittsburgh, Pa., assignor to the Westinghouse Electric and Manufacturing Company, same place. Filed Feb. 28, 1894.

532,354. Lightning-Arrester. Alexander J. Wurtz, Pittsburgh, Pa., assignor to the Westinghouse Electric and Manufacturing Company, same place. Filed Aug. 3, 1894.

532,391. Electric-Lamp Support. James Nortney, New Albany, Ind., and Frank Schefold, Parkersburg, W. Va. Filed Oct. 18, 1892. Renewed Dec. 12, 1894.

532,393. Guard for Street-Railway Cars. William H. Paugh, Columbus, Ohio. Filed June 25, 1894.

532,411. Illuminated Street-Car Sign. James M. Allison, Indianapolis, assignor of one-fourth to Andrew M. Banks, Marion County, Ind. Filed July 5, 1894.

ELECTRICAL AGE

Vol. XV., No. 4. NEW YORK, JANUARY 26, 1895. Whole No. 402

Established 1883.

Entered at New York P. O. as second-class matter, January 18, 1891.

THE ELECTRICAL AGE PUBLISHING CO., Publisher

TERMS OF SUBSCRIPTION:

One Copy, one year,	$3.00
One Copy, six months,	1.50
Great Britain and other Countries,	4.00

Cable Address (all Cables,) "Electage," New York.

W. T. HUNT, President. F. N. BASSETT, Vice-President.
T. R. TALTAVALL, Secretary and Editor.
NEWTON HARRISON, E. E., Scientific Editor.

ADDRESS ALL COMMUNICATIONS TO
THE ELECTRICAL AGE PUBLISHING COMPANY,
First Floor, World Building.
NEW YORK.

NEW YORK, JANUARY 26, 1895.

CONTENTS.

THE RAPID TRANSIT PROBLEM.

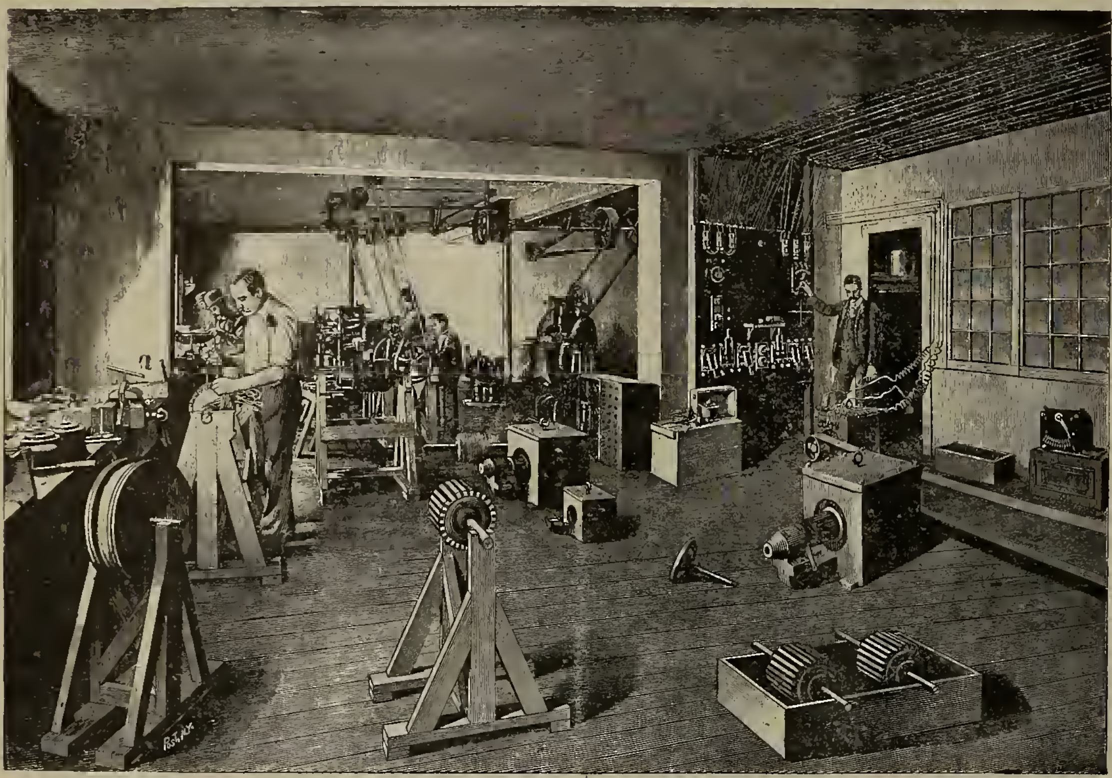
The plan of rapid transit for New York city, described on another page of this issue, seems to be one of the most feasible of all so far proposed. It involves the least construction work of any, and at the same time avoids the necessity of going underground, in the ordinary sense of the word. There are serious doubts about the proposed tunnel plans. The people would prefer to be on or nearer the surface, and Mr. Leschziner's plan seems to more nearly approach this desirable condition than any other that the rapid transit commission has so far considered. The simplicity of the plan commends itself, and the rapid transit commission should give it their careful consideration. Mr. Leschziner has some very practical ideas on the subject.

THE SITUATION IN BROOKLYN.

At this writing the strike of the employés of the Brooklyn trolley lines continues, attended with considerable violence. The circumstances outlined by us in our last issue have all occurred, and the state troops have been called out to guard the railroad companies' property and those of their employés engaged in operating the cars. Brooklyn's police force proved inadequate in the extreme emergency, and the troops were called on to afford the companies the necessary protection in order to reopen their lines. The presidents of the companies claimed that they had plenty of men to fill the places vacated by the strikers, but it was proved on Monday that they could not get enough men to resume the regular schedule. The result is that with the combined protection of the city and state the companies are unable to fulfil their promise to resume regular service when sufficient protection was afforded. This places the companies in a rather serious predicament, and there is already talk of beginning proceedings to annul their charters because of their inability to render the service necessary, and which they promised to render when their franchises were obtained. To admit, as they have done, that they cannot get enough men to run their cars, is an acknowledgment that they are unable to carry on their business. This being the case there is only one of two courses for them to pursue – either surrender their charter to some one who can run the business, or grant the men the increase of wages they ask. The people of Brooklyn through their representatives in authority should now take prompt and positive measures to bring the existing state of affairs to a head. If they do not they will, by their neglect to act, simply give and acknowledge the right of the street car companies to do just what they please. The strikers are evidently getting the better of the companies by winning over to their cause the new men as they are placed in charge of the cars. As we pointed out last week, they can accomplish more by moral suasion than by any other means, and by their adoption of such measures they have succeeded in seriously crippling the companies. A good many acts of violence have occurred during the week, and these are greatly deprecated; but it would be hardly fair to charge the strikers themselves with being responsible for such acts. It is well known that, as a rule, such unlawful demonstrations are chargeable to the sympathizers and mob element and not to the strikers. Nobody can prevent a striker from buttonholing a new man the first chance he gets and cause him, by argument, to desert the company's service. The effects of such methods are apparent in this case. The companies are now seriously embarrassed, to say the least, and the strikers seem to have the best of the situation. It would be a bitter pill for the companies to yield now to the men, but they may have to come to it, or go out of business.

A. B. SEE ELECTRIC ELEVATORS.

Electric elevators, through their ease and reliability of action, the small space required for the mechanism and facility of control, besides many other important advantages, are rapidly growing in favor. In many of the large public and private buildings, and in private dwellings electric elevators are in constant use, and give the best of service.



ELECTRIC MOTOR DEPARTMENT, A. B. SEE MANUFACTURING CO.

The general public has, however, little idea where such elevators are made, and how extensive the industry is, and it was for the purpose of giving the readers of the Electrical Age a little insight into this interesting business that a representative of that paper a few days ago visited the large factory of the A. B. See Manufacturing Company, in Brooklyn, N. Y.

This concern is noted widely for its electric elevators. It has a very large manufacturing plant at 116–120 Front street, Brooklyn, which is equipped with the most modern machinery.

The building is of brick, and about 75x150 feet in dimensions and three stories high.

On the first, or ground floor, are located the motor and winding rooms, the engine room, the stock room and the machine shop ; the office, woodworking department and pattern rooms being on the second floor.

The motor room is at the left of the main entrance and faces on Front street. It is of ample size and fully equipped with every machine and convenience necessary for carrying on the particular work to which it is devoted. Here the field magnets and armatures are wound, and the motors assembled, finished and tested.

In this room is a die cutter for shaping armature disks ; lathes for turning up armatures, drill presses and a milling machine used in cutting slots in the armature cores after the cores are built up. The armature core is made up of disks of especially prepared soft iron, which give very excellent results, the heating of the core being almost negligible.

The field magnets are made of cast steel by the Illingsworth Co., of Newark, N. J. They are wound by machine, there being three winding machines in the shop.

The motor is iron-clad and nearly square in form. It is said to be a very efficient machine, and is entirely of the company's own design. In our illustration of the motor department, is seen a motor being tested. In the process of testing, the motor is made to drive a dynamo through a belt connection, the efficiency of the motor being determined in the usual manner.

In this department of the works there is a drying room, where the armature and fields are dried after having been wound and shellacked. The drying room consists of a large box in which the articles to be dried are placed, and after closing the doors and barring them tightly, the heat is turned on in the interior.

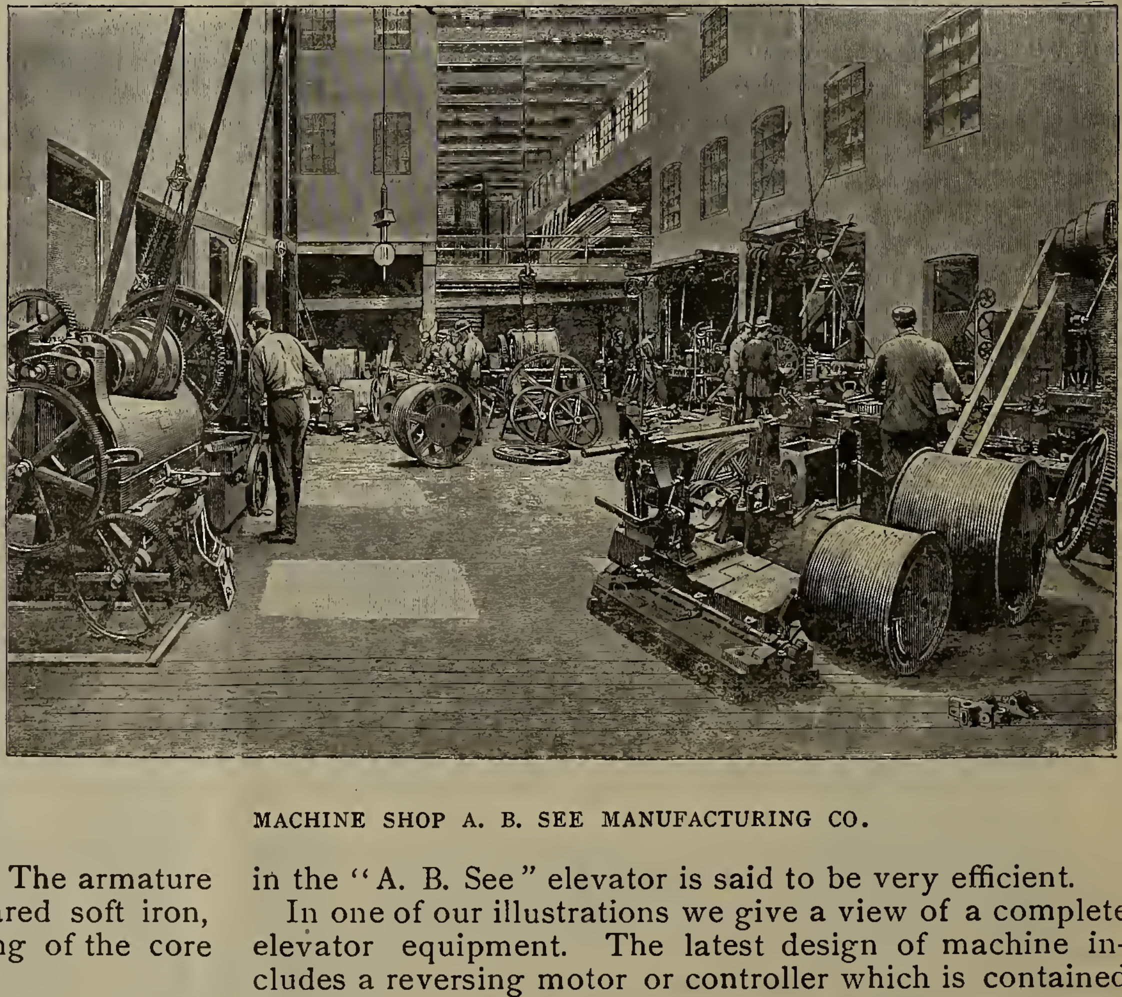
The testing switchboard shown at the right, in the view of the motor department, is a very complete piece of apparatus and embodies some special features designed particularly for testing purposes. From the same board all the shop lights are also controlled.

The company generates its own current in the daytime, using one of its own machines, and at night, after the engine has been shut down, the Edison street current is taken, the change from one system to the other being effected by means of a double-throw switch.

The range of power of elevator motors made by this concern is from 1 to 20 horse-power.

The machine shop is located at the back of the motor department. The second floor forms a gallery around the shop, a large skylight in the roof affording an abundance of light on the groundfloor, where the various heavy machines are located.

At one side of the machine shop, and in the opening under the skylight, is a fully equipped elevator and car in practical operation. It is fitted up for testing purposes, to ascertain the efficiency of the machine as a whole. The motor used has a lifting power of 2,500 pounds, and the car runs to the roof of the shop. The worm screw used in the "A. B. See" elevator is said to be very efficient.



MACHINE SHOP A. B. SEE MANUFACTURING CO.

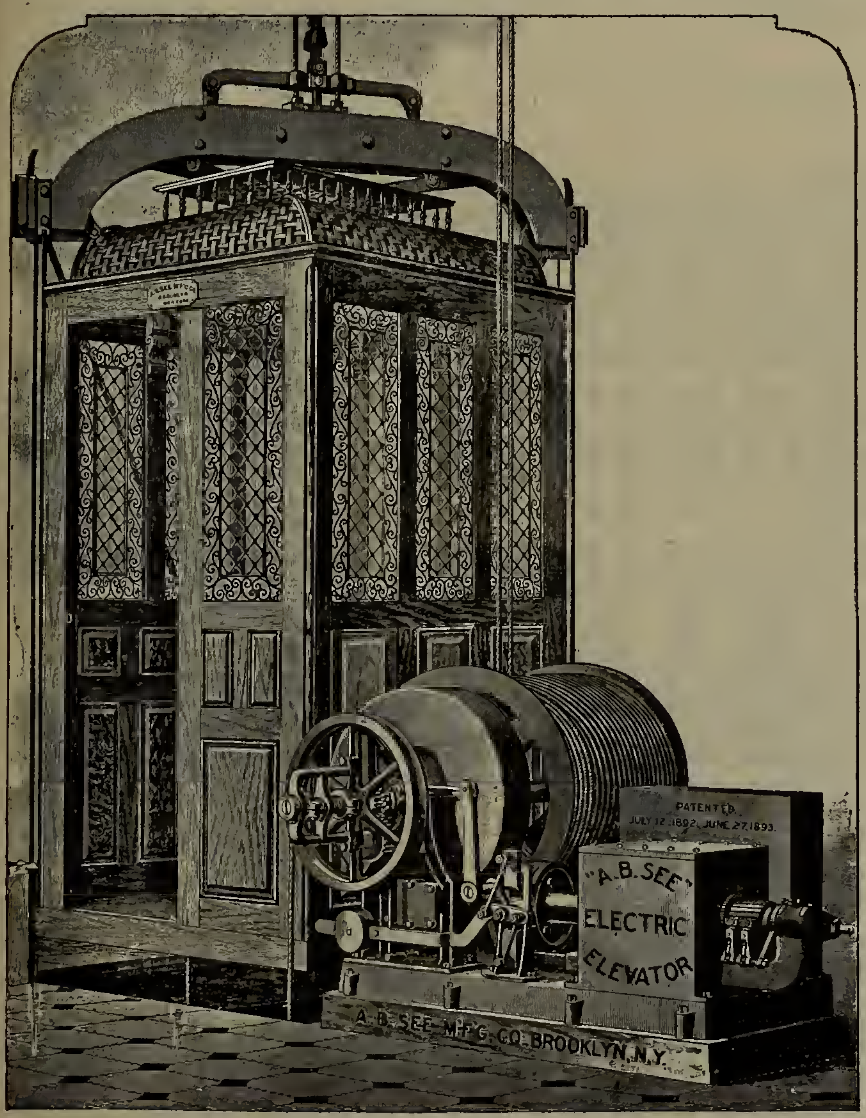
In one of our illustrations we give a view of a complete elevator equipment. The latest design of machine includes a reversing motor or controller which is contained in an iron box placed on top of the motor. This reversing device is not shown in our illustration, however.

The controller operates the switch in the switch box seen just behind the motor. In starting, the car resistance

is cut out gradually by an arrangement of a solenoid in the switch box. The solenoid prevents any jerking action when the current is first turned on.

In the machine shop there are lathes of many different sizes and for many different purposes. Among the other machines are shaping machines, drill presses and planers. The largest lathe (seen at the left in the view of the machine shop) is eight feet long and has a five-foot swing. It is used in turning up drums and sheaves, and will take work seven feet long. A smaller lathe, with a 4½-foot swing, is used in boring out the fields of the motors and turning up gears. The cutting of worms is done on a specially designed lathe.

The company in addition to the large amount of its regular work is now building a small electric dumb waiter for houses, etc. It embodies entirely new features and is ex-



A. B. SEE ELECTRIC ELEVATOR.

pected will be the best device of the kind for practical use. It is of entirely new design. The company is also making an electric sidewalk elevator that is a very efficient machine; for freight work the belted machine with worm gear is very powerful, and for heavy freight their square gear machine is said to be the best made

Adjoining the machine shop are the tool and store-rooms. In the former all of the hand tools, etc., are carefully kept when not in use, and in the store-room a complete stock of supplies of all parts of machines are kept on hand, so that orders can be filled with the least possible delay.

The company even does its own forging and has a forge in operation for the manufacture of machine parts

One of the most interesting machines in the machine shop is a large planer for planing motor beds, etc. This powerful tool planes iron surfaces with great accuracy. There is also a stock room where lumber, iron and other metals in the rough are kept A plentiful supply of all is always available to meet the great demand in so large a business. On the same floor is located the engine room. The engine, which is a New York Safety high-speed, supplies the power for the machine shop and runs a 225-light dynamo, of the "A. B. See" pattern. The dynamo is belted to countershafting. At night time, when the engine is shut down, the power to run the shop is supplied by "A. B. See" motors, taking the Edison street-current.

On the upper floors of the building are situated the woodworking department, draughting rooms and general offices of the company.

The woodworking plant is a specially fine one, but is none too fine for the class of work that is required to be turned out of this establishment. There are saws of all kinds, polishing machines, lathes, tenoning machines and other devices necessary to facilitate the rapid production of first-class work.

In the construction of the elevator cars only the best quality of lumber is used. The wood most generally used is quartered oak, with maple floors, and the latter wood is also used for the guides.

Necessarily pattern making is a very important part of the work in a large establishment of this kind. The company makes its own patterns for everything, and employs the most skilled labor for this purpose.

The floor is lighted by incandescent lamps, while in the shop arc lamps supply the necessary light.

The draughting rooms and offices are located at the front part of the building, and are very light and admirably suited for the purpose.

The "A. B. See" Manufacturing Company, it will be understood from the foregoing, has the best of facilities for turning out its elevators. The operations of the company, however, are not confined to the manufacture of electric elevators alone. While this class of elevators is the special feature of the business, the company as well makes passenger and freight elevators, to be driven by steam engines or gas engines.

Regarding the electric elevators it may be said that their special features are great strength, compactness and efficiency. They are all provided with the company's patent automatic controller.

This company claims the distinction of being the only one in the United States that manufactures electric elevators entirely in their own factory and under their own patents.

ELECTRIC TRAINS ON THE NEW YORK, NEW HAVEN AND HARTFORD R. R.

FURTHER FACTS FROM PRESIDENT CLARK.

Regarding the decision of the New York, New Haven and Hartford Railroad Company to equip one of its branch lines with electric power for the operation of trains, about which we made reference in our issue of last week, we have received a few further facts from President Charles P. Clark, of that company. President Clark states that their plans are not yet sufficiently developed to enable him to give any definite information. The company expects to be able to equip and use standard coaches capable of drawing the ordinary passenger equipment as trailers; to provide electric motors for other and heavier trains, and to apply electricity in such a way as not to interfere with the use of the road by the ordinary locomotive whenever required.

President Clark also verified the report that the Nantasket Beach line is the one to be so equipped, the Directors of the company having so decided on January 12.

This is the first step taken by any regular steam road in the direction of introducing electric motive power, and on account of its immense importance and bearing on the future of such enterprise the results of this experiment will be watched with the deepest interest by everyone interested in the subject.

The police of Mt. Vernon, N. Y., last week discovered evidence of a plot to tap Western Union wires for the purpose of getting the better of pool rooms. The promoters of the enterprise, however, were not found, and the scheme was killed.

NEW PLAN FOR RAPID TRANSIT.

Mr. Siegfried Leschziner, of 191 Schermerhorn street, Brooklyn, has a plan for rapid transit in this city that has some meritorious features. As this question is an all-important one in New York at the present time, a general description of Mr. Leschziner's plans will be of particular interest.

Mr. Leschziner believes that the tunnel idea for a railroad is all wrong. People don't want to go underground, he says, while they are alive, and there is no excuse for building an underground road when a much superior construction can be had in the open air, where there is daylight, and at less cost.

His plan, in brief, is to construct a three-deck elevated road through the middle of the blocks. Twenty-five or thirty feet of ground through each block will give sufficient space for the road, and on the land is to be erected a massive structure of brick up to the second story line. The substructure is to be arched so as to provide free passageway beneath. Upon this substructure the railroad company could build as many levels of track as it pleased.

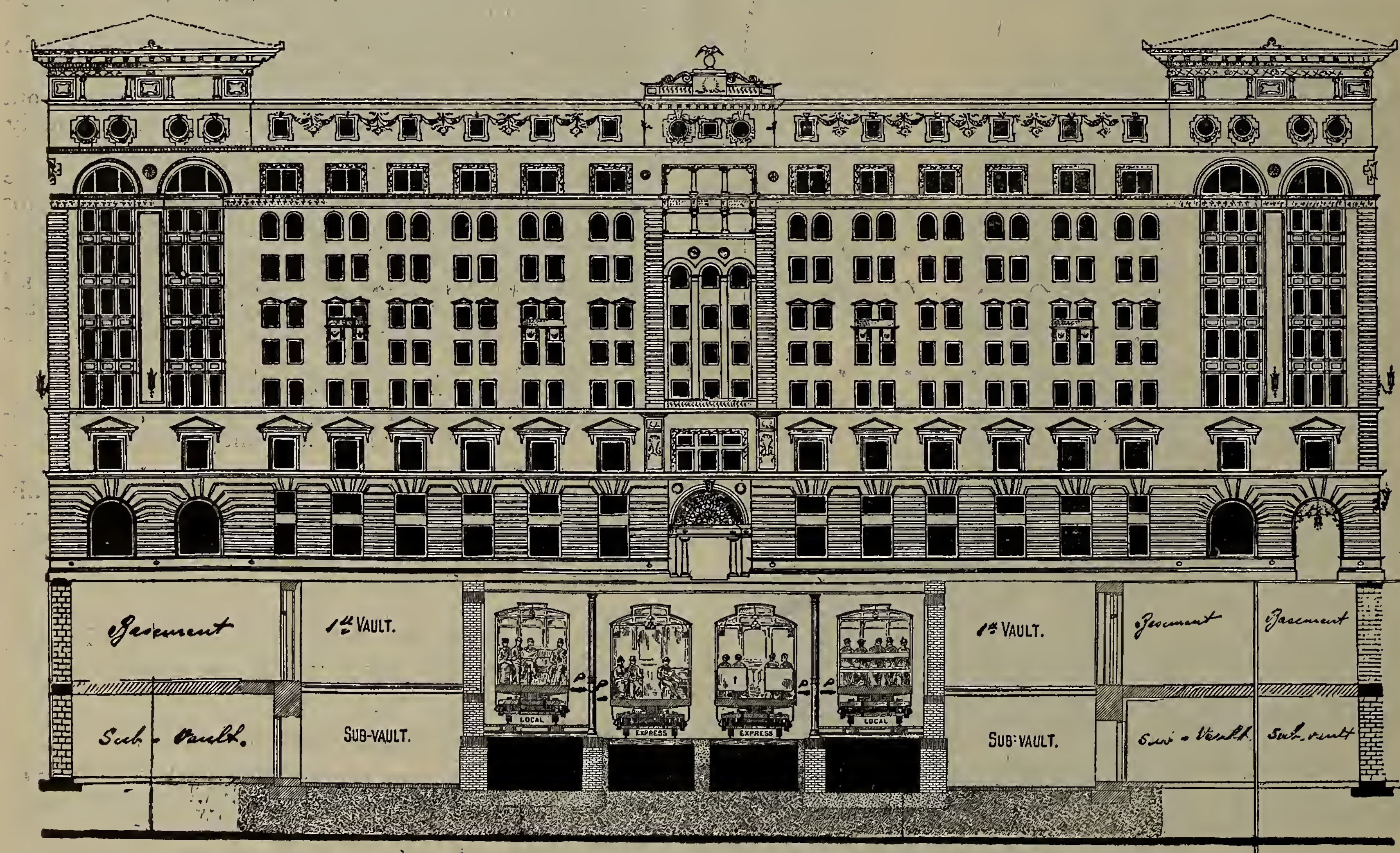
Mr. Leschziner has a plan of a road to be constructed after his idea providing for a three-story structure with ten separate tracks. Upon the arched substructure are laid four tracks, and above these, on the super-structure are four more tracks immediately above those on the first level, and then, on the third level there are two tracks, with space for two more. The plan also provides for depressing the first tier of tracks below the surface of the ground where necessary so as to avoid grade crossings, and to continue the line any distance beyond the city limits. The depressed sections of the road of course would only be required up to the city limits and then the road could be continued on the arched substructure.

This method of construction provides almost unlimited possibilities for future enlargement, and Mr. Leschziner proposes, by his plans, to continue the road from New York to Niagara Falls, the State assuming the ownership. In this way not only would the city itself be provided with rapid transit, but passengers could be transported long distances beyond the city, almost from the very doors of their houses, without change of cars.

The disposition of traffic on ten tracks would be an easy matter, and seats would be provided for all. Passengers could be distributed at more rapid speed along the route and with less loss of time than is possible with any other system yet suggested.

Mr. Leschziner claims that his system provides ample means for rapid service, not only for 25 years to come, but for all time. Such a construction, of course, would cost considerable money, but it will meet every demand and be satisfactory to the public. The same cannot be said of any underground system.

This plan certainly has some excellent features. In crossing streets the road would be carried over arched structures, and between streets, or through the blocks, little of it would be seen. Therefore the objection heretofore raised against elevated structures in general does not seem to have any standing in this case. The right of way through the blocks would have to be acquired of course.



VIEW OF LESCHZINER'S PLAN II, FOR RAPID TRANSIT IN NEW YORK CITY.

This would be the greatest item of expense, but set against this is a road that cannot be approached for completeness, provision for future enlargement, and the absence of objectionable features.

It is Mr. Leschziner's idea to operate the road by electric power.

Mr. Leschziner has a modified plan of his system, which he calls Plan II, an illustration of which is given herewith. It shows a depressed road running through private property in the middle of the block, said property to be acquired by the city whenever the route is decided upon. The plan is to build such a road on the east and west sides of the city, the two divisions converging at City Hall Park and continuing down Broadway to Battery Park, around which the road forms a loop, and returning up Broadway to the City Hall, where the east and west side tracks divide. Cross roads are to be constructed to connect the two main divisions on such streets as may be desirable.

Our illustration of Plan II shows the road to be of four tracks, two for express service and two for local, with platforms marked at P. The necessary property for the erection of the road is to be acquired by purchase or by condemnation proceedings. At street crossings the street would be built over. A depth of 13 or 14 feet would be all that would be necessary for the building of a road on

this system, hence very little excavating would be necessary. Mr. Leschziner estimates that the cost for the construction of such a road would not be half of that estimated for proposed roads, and he thinks that the cost of the road complete, including payments on account of property acquired, would not amount to as much as would the excavation of the tunnel roads so far proposed. The routes and extension features are practically the same in both plans. When the road reaches the city limits the idea is to continue it as far as necessary.

Mr. Leschziner is of the opinion that a road constructed on the lines laid down in his Plan II, would cost a great deal less than the $50,000,000 voted to be expended in the construction of a rapid transit system, and be more practical, besides, than any of the tunnel systems.

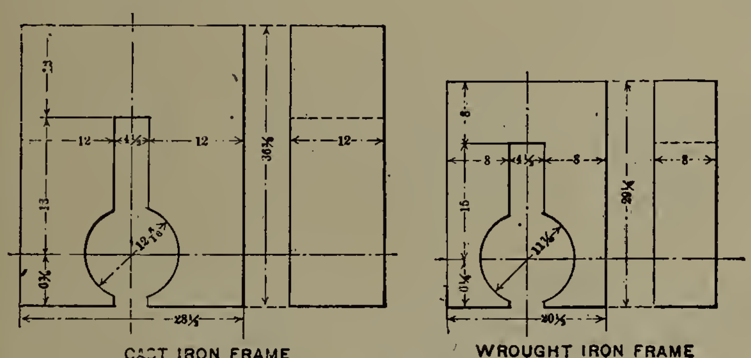
The plans provide for suitable stations, etc., and Mr. Leschziner will be glad to give all information desired respecting his plans to interested parties.

THE BEST METAL FOR FIELD MAGNET FRAMES.*

BY ALTON D. ADAMS.

Cast-iron, cast-steel and wrought iron being the materials at our command for field magnet construction, it is an important question to the engineer and manufacturer which will produce a dynamo of given capacity, speed, efficiency and working qualities at the least cost.

I am not aware that any of the works on dynamo construction attempt a definite answer to this question, and



FIELD MAGNET FRAMES.

the practice of builders is by no means uniform. Economical points of saturation requiring about the same magnetizing force per unit of length in each metal, are for cast-iron a little under 40,000, cast-steel 70,000 to 80,000 and wrought-iron about 90,000 lines per square inch.

The cost of cast-steel is fully equal to that of forgings in simple shapes, and as it lies between cast and wrought-iron in magnetic qualities, the cost of machines made with it will be between those of cast and wrought-iron. A comparison will, therefore, be made between the cost of the latter two.

To be fairly compared, machines of different materials must be equal as to magnetic flux in field and armature cores, ampere-turns on armatures, field ampere-turns required in air gaps and as nearly as possible in magnet frames, watts used in windings and be of the same capacities and speeds.

Taking wrought-iron at a saturation of 90,000 and cast at 40,000 lines per square inch, the section of an equivalent cast will be two and one-quarter times that of a wrought frame and as the length of the cast-iron frame must be a little greater to give enough winding length, its weight will be about two and one-half times the wrought. A saving is thus at once made in favor of the wrought magnet, as forgings can be had per pound for much less than two and one-half times the cost of cast-iron.

The same number of ampere-turns and watts being required for the coils of the cast as the wrought-iron magnet, and the weight of wire varying as the square of its length, the coils for the cast-iron frame will be much heavier. The armature core may have the same diameter in each frame, but must be longer in the cast frame so as to come under the pole-pieces, thus materially increasing its weight.

As for the same resistance, the weight of armature winding increases as the square of its length, considerable more wire is required for the armature core of the cast-iron machine. In addition, the purely mechanical parts, shaft and base must be larger and more costly in the cast-iron machine, because of the greater weights they have to carry.

To illustrate the difference in cost of construction, the following data of two machines is presented, each having capacity of 25 K. W. of 1,275 revolutions per minute, the same winding losses, the same ampere-turns on armatures and field ampere-turns in air-gaps equal to about twice the armature ampere-turns active at the pole corners.

The air-gaps and armature cores of each machine are crossed by 4,320 000 magnetic lines and allowing a leakage of 25 per cent. the field core must furnish 5,760,000 lines.

A wrought-iron field to carry 5,760,000 lines, at 90,000 per inch saturation, requires a section of 64 square inches, which is provided by a core of eight inches square and a cast-iron field at 40,000 lines per square inch requires a section of 144 square inches provided by a core 12 inches square.

Allowing sufficient length for magnet windings, the same air-gap resistance and an armature core of 11 inches diameter for each of these frames, their dimensions will correspond to the following drawings:

The weights of these frames are—

Wrought-iron frame . . . . 1020 lbs.
Cast-iron frame . . . . 2730 "

For work as shunt motors the wrought-iron machine requires 11,000 ampere-turns in the air gaps and 2,000 in iron, the cast machine 11,000 ampere-turns in air-gaps and 3,800 in iron.

With 440 watts expended in field coils of each machine, an average length per turn of 38 inches in the coils for wrought iron and 54 inches in the coils for cast iron, the weights of these coils are

Wrought-iron machines . . . . 100 lbs. copper.
Cast-iron machine . . . . 280 " "

The drum armature for the wrought frame is 11 inches diameter and eight inches long, that for the cast frame 11 inches diameter and 12 inches long, without allowance for shaft hole.

The weights for armatures are

Wrought-iron machine . . . . 133 lbs. disks.
Cast-iron machine . . . . 340 " "

With a loss at full load of 490 watts in the armature winding for wrought-iron machine and 464 watts in the armature winding for cast-iron machine these windings require in

Wrought-iron machine . . . . 49 lbs. copper.
Cast-iron machine . . . . 71 " "

The above indicates plainly the great saving of wrought over cast-iron in dynamo construction.

From the users' standpoint the wrought-iron machine seems preferable on account of its lesser weight and bulk, this difference being especially marked in machines for direct connection to engines and other purposes where slow speed is necessary.

* A paper presented at the ninety-third meeting of the American Institute of Electrical Engineers, New York and Chicago, January 16, 1895.

An electric railway is to be established between Montiers and Brides-les-Bains, Savoy, the power to be obtained from two water-falls in the neighborhood.

Postal long distance telephone lines have been opened between Leeds and South Wales, and Merthyr Tydfil and Newcastle-on-Tyne, England.

PRINCIPLES OF DYNAMO DESIGN.

BY

Newton Harrison, E.E.

(*Continued from Page 37.*)

The Choice of Metals.—Although the proper consideration of leakage will greatly determine the shape or type of a frame, another factor of equal importance presents itself to our immediate notice.

There are many grades of magnetizable metal on the market whose use has given rise to much discussion as to which is cheapest and best for dynamo frames.

The use of cast iron was a general practice, and is to a limited extent today, because of its apparent cheapness and ease with which it could be moulded to any shape. But it has been superseded of late by a metal which we can cast and handle with the same facility, and whose magnetic qualities are so greatly superior in every respect that experience would immediately demand its use.

This metal, called cast steel, possesses the most desirable qualities; high permeability, and practically the same ease in casting as cast iron itself.

The metal which for many years was considered the most economical for smaller types, but which was occasionally used for cores of larger machines, was wrought iron. It was generally forged into shape, if used for both core and pole-piece. This in itself was necessarily a great expense; the use of dies to produce the drop-forgings limited the size of the forging and implied an additional cost for wear and tear of dies to be considered in the price of the metal per pound.

The practice was quite prevalent to have wrought-iron cores but cast iron in every other part of the frame.

The Edison Company use in their bipolar types of machines, wrought-iron cores and keepers, but cast-iron pole-pieces. There is a great objection to the butting together of cast and wrought iron unless proper provision be made for such an arrangement. The magnetic flux issuing from a wrought-iron core and passing into a body of metal of greater magnetic resistance at the surface in contact would tend to throttle the lines of force and reduce them in number. It therefore becomes necessary to use a large wrought-iron washer between the two, if the case of a wrought core and cast pole-piece be considered. The area of cross-section of this washer should be sufficient to allow the lines of force to pass into the cast iron at a normal specific induction, otherwise a junction without the above precautions will mean an interposed resistance in the magnetic circuit.

The great objection to cast iron has always been due to the fact that its permeability is very low in comparison with wrought iron or cast steel. It has invited the attention of engineers because of the ease with which it could be manipulated to any shape. But this objection of low permeability and at saturation of only approaching an induction of eight to twelve thousand lines of force per square centimeter, which again necessitates a longer ampere turn than would be required for the same magnetic output in wrought iron, has for reasons of economy almost entirely excluded it from general practice for entire frames. As an illustration:

A square inch of wrought iron will have a magnetic flux at saturation of a hundred thousand lines of force, while the same cross-section of cast iron will give only sixty thousand lines of force with a number of ampere turns greatly exceeding those required for the wrought iron; this fact is of considerable importance to the practical engineer. Space and weight are factors which at times must be brought to a miminum value, and a metal of high permeability will effect this often desirable end. The relative values of cast iron and wrought iron are in the ratio of one to two, as regards their magnetic qualities.

At the present time cast steel is a metal whose high permeability has caused its general adoption in place of either wrought or cast iron. In its chemical composition it does not differ considerably from wrought iron and is in reality that metal itself.

The purity of iron or the absence of carbon changes its quality, so that we pass according to the respective quantities they contain from cast iron to steel and from steel to wrought iron. Steel, or more properly mild steel, therefore belongs to the family of wrought irons, not only in this respect but in the possession of a very high permeability, such that many makers have denied its inferiority to wrought iron. As it can be cast into any shape all objections to its use fall away and machines of today can be made without a single joint and possessing the average permeability of wrought iron in all parts.

Mr. Alton Adams has made some calculations on this subject and produced the following figures, showing the relative weights of cast and wrought-iron frames producing the same number of lines of force:

Wrought-iron frames	1020 pounds.
Cast-iron frames....................	2730 "

Although steel has been left out of this calculation, the figures for wrought iron in all probability would not vary ten per cent. from those for cast steel. Mr. Adams has stated that the relative points of saturation in the three metals are: for cast iron, 40,000; cast steel, 80,000, and wrought iron, 90,000 lines per square inch, but the experience of other manufacturers brings these figures up to a greater value. It being granted for the sake of argument that wrought iron was 20 per cent. superior to cast steel, the cost of handling it would not be an incentive to its use in comparison with cast steel. Drop-forgings have a value of six to seven cents a pound and cast steel but four cents a pound, so that a choice of the two would be at once determined in favor of the latter. The amount of copper used in each of the above-mentioned cases would also vary. Cast iron would require two and possibly three times as much copper to produce the same magnetic flux as either wrought iron or cast steel, so that the cheapness of cast-iron does not imply a corresponding saving by its use; on the contrary, it means more copper, a larger frame, a greater weight and a greater difficulty in handling. Wrought iron, while greatly superior, cannot be handled with the same ease. We are limited in the size of forgings because of the great expense, and we cannot produce a machine as solid, mechanically, as one whose structure is complete in every part. Cast steel, whose only possible inferiority to wrought iron may be caused by blow-holes, covers the objections to both these metals by possessing all their good qualities and none of their bad ones. It may be well understood from the start that the severe conditions of practice may utterly remove the question of a few per cent. gain by the use of either wrought iron or cast steel. The question lies more with the builder, to whom the saving of any amount which does not involve the expenditure of an equal sum, is from the standpoint of economic design a most desirable object.

(*To be Continued.*)

BUFFALO'S NEW ENGINEERING SOCIETY.

The Engineering Society of Western New York has been organized in Buffalo and is now looking for suitable quarters. In order that the society may be put on as high a plane as possible, the charter members will be confined to members of various engineering societies of the United States, including the American Institute of Electrical Engineers. The objects of the society are similar to those of engineering bodies in general. Meetings will be held on the first Monday in each month. The officers are: President, George E. Mann; Vice-President, E. B. Guthrie; Junior Vice-President, Walter McColloh; Secretary and Treasurer, Geo. R. Sikes; Directors: Geo. B. Burbank and C. M. Morse.

ON THE UNITS OF LIGHT AND RADIATION.*

BY A. MACFARLANE, D. SC., LL. D.

One of the recommendations made by the sub-committee of the Institute in the programme for the International Electrical Congress at Chicago, was that the practical unit of illumination should be defined as the illumination produced by the bougie-decimale at the distance of one metre, and that this unit should be denominated the bougie-metre. To this definition little objection was made, excepting that Professor Nichols pointed out that it involved an arbitrary standard of light which had no relation to the C. G. S. system of units. More general objection was taken to the notation for the unit.

The London *Electrician* for February 3, 1893, objected to the "bougie-metre," that all other such compound names imply a product of the components, while in this case the former component is divided by the latter, or, more correctly, multiplied by the square of its reciprocal; and suggested, half seriously, that instead of "candle-foot" we ought on the "mho" principle to speak of "candle-toof-toof."

M. Hospitalier made the same objection, that "bougie-metre" according to existing usage means a product, and suggested "bougie-at-a-metre," or, if that were inadmissible the use of a new term such as "lux." M. Blondel favored the single term "lux," and Mr. Lockwood, the single term "davy."

Consider the philosophy of the substitute suggested by the *Electrician*. If we attempt to formulate the "mho" principle, we find that it may be expressed as follows: The reciprocal of a given unit may be denoted by writing the name for the direct unit backwards. It supposes that the given unit can be expressed as the ratio of two other units; thus, ohm is the single name for the ratio, volt per ampere. The reciprocal idea is ampere per volt, and there is a convenience in not introducing a new and independent word, but in denoting it instead by the direct term written backwards.

It appears to the writer that here we have a principle which might well be adopted in mathematical analysis, for we have all felt the want of a suitable notation for a function, which is the reciprocal of a given function; for example, the reciprocal of *tan* or *sin*. English and American writers use tan^{-1} and sin^{-1}, a notation which is half word, half symbol; which cannot be pronounced; and which suggests the reciprocal quantity instead of the reciprocal function. Continental writers use "arc tan" and "arc sin," which are too long and periphrastic. On the "mho" principle, the reciprocal of "tan" is "nat" and that of "sin" is "nis." Let $x = \tan y$, then $y = \text{nat}\ x$; let $a = \sin b$, then $b = \text{nis}\ a$. According to Lord Kelvin, who, I believe, introduced the "mho" notation, the expression for a function should consist of three letters; and it may be added, the middle letter ought to be a vowel, the other two consonants. Such a syllable notation when inverted remains a syllable. This notation would have the advantages of being short, unambiguous, articulate and logically connected.

But in the case of a fundamental unit, such as the foot, is there any reciprocal idea? It is true that there are physical quantities which have the dimension l^{-1}; but on examination they will be found to express a physical ratio of some kind. For example the unit of curvature has the dimension l^{-1}; it is expressed by radian per foot. The reciprocal unit is foot per radian, having the dimension l; it is not a measure of length, but of flatness.

The difficulty experienced in expressing the intensity of a candle or other spherical source arises from the want of a name for the unit of solid angle. Just as the natural unit for plane angle is metre of arc per metre of radius, so the natural unit for solid angle is square metre of spherical surface per metre of radius squared. The name "radian" given to the former unit (Everett's "Units and Physical Constants," 1879), has been very useful in expressing exact ideas; a recognized name for the latter unit would also be highly useful. For this purpose the word "steradian" was introduced by Dr. Halsted in his Metrical Geometry in 1880, and I have used it in my work on Physical Arithmetic. Though not faultless from the point of view of the etymologist, it is sufficiently expressive to the physicist.

How then is the unit of illumination properly expressed? Suppose that by "bougie" is meant the current of light which streams from a uniform standard candle through one "steradian," then the illumination anywhere may be expressed in terms of bougie per square metre, where the former component refers to the current, and the latter to the cross-section. But in the case of light streaming from a point source, the illumination may be expressed in terms of (bougie per steradian)-(steradian per square metre), where the former component refers to the intensity of the source, and the latter to the solid angle subtended at the source by one square metre of cross-section. If "lux" is the single term for this unit, we have

lux = bougie per square metre.

= (bougie per steradian)-(steradian per square metre).

Hence, candle per square foot or (candle per steradian)-(steradian per square foot) is the proper expression for the candle-toof-toof of the *Electrician*.

According to the above definition of "bougie," the total current from the candle would be 4π "bougies." But if "bougie" is defined to mean the total current from the candle, and by "lux" is meant the same quantity as before, we should have

$$\text{lux} = \frac{1}{4\pi}\ \text{bougie per square metre.}$$

We cannot logically avoid the 4π; exclude it from the source it appears in the intensity, and *vice-versa*. This point is overlooked in the established system of magnetic units and forms the basis of Heaviside's rational system.

The use of the hyphen to denote a product unit is not very appropriate, for it suggests the sign minus rather than the sign of a product. It would be better if it were omitted altogether and the two component units amalgamated as in footpound and kilogrammetre for then the nomenclature would correspond to the algebraic convention which leaves the sign $\times$ to be understood, and in addition the hyphen would be set free to denote any compound unit other than the product or quotient.

If we consider the general subject of radiation we shall be led to distinguish the following ideas with their corresponding units:

Quantity of radiant energy of whatever kind can be expressed in ergs, and a *flow* in ergs per second. By *strength of source* is meant the whole quantity of radiant energy which leaves the source in a given time divided by the time; the appropriate unit is erg per second. The *intensity of a source* is differently expressed, according as the radiation is spherical, cylindrical, or plane. In the first place it is the ratio of a current through a solid angle to the solid angle, and hence it is appropriately measured by the erg per second per steradian. In the second case it is the ratio of a current through a wedge-angle to the wedge-angle. There is no recognized unit of wedge-angle; as it involves the radian in one plane and a length along the perpendicular to that plane, it may be expressed by cm.-radian. Hence the intensity will be expressed in erg per second per (cm.-radian). If the radiation proceed from an infinite plane, its intensity is measured in terms of erg per second per cm^2.

By the *density* of the radiation at any point of a source is meant the ratio of the flow normal to a small surface to the small surface, and is expressed in terms of erg per second per cm^2. By *intensity of current* anywhere, is meant the ratio of the flow through a small cross-section to the cross-section, and is also expressed in terms of erg per second per cm^2. By *time flow* is meant the ratio of the energy which has passed through a cross-section to the cross-section; it is expressed in terms of erg per cm^2.

The above is the appropriate system of C. G. S. units for

* Abstract of paper presented at the ninety-third meeting of the American Institute of Electrical Engineers, New York and Chicago, January 16, 1895.

any kind of radiation measured simply as energy. But in the case of light the eye exercises a selective power, not only singling out a certain range of wave-lengths, but discriminating among them as to amount. If one of the units is defined with reference to this discrimination exercised by the eye, then the other units of the light system can be defined in terms of it, and the units of length and time.

THE ANIMAL AS A PRIME MOVER.*

BY R. H. THURSTON.

The Vital Engine, the body of every vertebrate animal—from the human ruler of all, down to the lowest organism having a cartilaginous frame—is today well recognized, as, in the engineer's classification, a "prime motor," in which the latent forces and energies of a combustible "food," of a fuel, as many suppose it, are evolved, transferred and transformed to perform the work of the organism itself, to supply heat to keep it at the temperature necessary for the efficient operation of the machine, and for the performance of external work. The value of the machine as a prime mover is dependent upon the relation between this external work, so far as it can be applied to useful purposes as labor, and the costs of its production in fuel or energy supply, and in wear and tear and replacement, precisely as with any other machine of the class, whether the source of power be chemical, thermal, electrical or vital.

The work of the machine is, however, a very different quality and is vastly different in quantity, useful work being compared with supplied energy and incidental expenditures from that of any other known motor. In the water-wheels and windmills the office of the motor is simply that of transfer of energy of flowing currents of fluid, of water or of air, and, without transformation, to mechanism suitable for giving it useful application. The heat engines develop energy previously "latent," potential, as the modern nomenclature would call it, into the kinetic form of thermal motion, and by transformation, so far as may be practicable, into the dynamic form, make it available for work. Electro-dynamic machinery similarly makes available by transformation the energy of the electric current; and none of these machines has any other function than that of making useful some one energy previously stored by the operations of Nature in such form as to be readily applied to his purposes by the hand of man.

The vital machine, on the other hand, has purposes and performs offices of essentially different kinds. It must not only transform the latent energies of the supplies received by it into useful external work, but all its work being directed toward the sustenance and preservation of the contained soul, as its principal and always essential purpose, all its operations being automatic or self directed, all its powers of transformation of energy are demanded for the production, by transformation, presumably, of (1) the vital forces and energies; (2) the physical energies demanded in constructing, rebuilding and operating the animal frame; (3) the external work required to furnish the body supplies, to protect it from decay or injury and to minister to the physical wants and ethical requirements of the personality of which it is at once the home and the vehicle.

This curious prime mover is thus an apparatus which, from familiar sources of energy, transfers and transforms, for its own purposes and applications, a variety of energies, performing a variety of work in various realms. The nature and composition of the sources of latent energy, always chemical compounds capable of oxidation, are well known; the character and method of many of the internal, as well as of the external expenditures of energy, are equally well understood; but there are a variety and considerable number of internal operations, involving transformations of energy, the nature and method of which are entirely beyond observation by any process of experimentation yet devised.

"Food" is taken into the body, enters into solution with the peptic fluids, elaborated from previously supplied nutriment, is absorbed into the circulation and disappears from our sight and reach; heat, carbon-dioxide, vapor of water, various salts and a considerable proportion of unutilized nutriment are rejected from the system and work is performed as the product of transformed energies and in large amount, both within the machine and upon external bodies. A chain of energy transformations is in continuous operation, of which we see the two ends, so far as the vital machine is concerned, but of which we only get occasional glimpses between the extremities, and some of the links of which are, as yet, undiscovered and unknown. It is certain that the series of changes, material and kinetic, involves familiar methods of transformation, and it is hardly less certain that singular and probably wonderful and unknown processes of energy, development and transformation are concealed within this miracle among machines.

* From the Journal of the Franklin Institute, Philadelphia, January, 1895.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

The ninety-third meeting of the Institute was held at 12 West 31st street, Wednesday evening, January 16, President Houston in the chair.

Prof. McFarlane, of Ithaca, N. Y., read his paper "On the Units of Light and Radiation," which was discussed by Messrs. Kennelly, Wolcott and Burnett.

It was voted subsequently that the paper be referred to the Committee on Units and Standards for consideration.

The paper by Mr. Alton D. Adams, of Boston, was read by the author and discussed by Messrs. Crocker, Richard Fleming, Sheldon, Ashley, Burke, Waldo, W. L. Bliss and Gano S. Dunn.

At the council meeting in the afternoon the following associate members were elected:

Anderson, Henry S., General Manager and Electrician, United Electric Light Co., Springfield, Mass.

Buck, H. W., Student in Electrical Engineering, Columbia College; residence, 14 E. 45th street, New York City.

Cox, Edmund V., Student in Electrical Engineering, Columbia College; residence, 50 E, 31st street, New York City.

Denison, Sylvester P., 143 Centre street, New York City; residence, Belleville, New Jersey.

Farnsworth, Arthur J., Chief Engineer, Larchmont Electric Co, Mamaroneck, N. Y.

Fisher, Henry W., Electrician and Director of Elec. and Chem. Laboratories, The Standard Underground Cable Co., Pittsburgh, Pa.

Fridenberg, Henry Leslie, M. E., Student in Electrical Engineering, Columbia College; residence, 60 E. 61st street, New York City.

Gallaher, Edward B., Electrical Engineer, 253 Broadway, room 910; residence, 1190 Madison avenue, New York City.

Klinck, J. Henry, Graduate Student, Cornell University, Ithaca, N. Y.

Lanphear, Burton S., Fellow and Graduate Student in Electrical Engineering, Cornell University; residence, 106 Union avenue, Ithaca, N. Y.

Leslie, Edward A., Vice-President and Manager, Manhattan Electric Light Co., Ltd., New York City; residence, 343 Hancock street, Brooklyn, N. Y.

Lester, William B., Western Union Telegraph Co, 195 Broadway; residence, 346 Lenox avenue, New York City.

Rennard, John Clifford, A. B. E. E., Assistant to Electrical Engineer, Met. Telephone and Telegraph Co.; residence, 302 W. 73d street, New York City.

Wright, Peter, Inspector of Electrical Works, United Gas Improvement Co., Philadelphia, Pa.

The following associate members were transferred to membership:

Abbott, Arthur V., Chief Engineer, Chicago Telephone Co., Chicago, Ill.

Marks, Louis B., Electrician, Marks-Ayer Electric Co., 73 Watt street, New York City.

Baillard, Edward V., Manufacturer of Electrical Instruments, etc., 108 Liberty street, New York City.

Broadnax, Francis, Engineer, Safety Insulated Wire and Cable Co., New York City.

ON THE DEGREE OF INCANDESCENCE OF LAMPS.

BY M. A. CROVA.

This is a note submitted by the author to the meeting of the Académie des Sciences, Paris, on October 15, 1894.

The degree of incandescence of lamps can be determined accurately by means of a spectro-photometer, but, for practical purposes, it can be obtained with sufficient precision by the method which I have proposed, and which was recommended by the Congress of Electricians in 1889.* The luminous intensity, as compared with the carcel, is determined by interposing before the eye a trough containing the mixture of chloride of nickel and perchloride of iron, in proportions allowing of the passage of part of the radiations comprised between the wave lengths, 630 and 534, with a well-defined maximum of 582; a second determination is made by placing before the eye a red glass, which transmits the radiations comprised between the red extremity of the spectrum and the vicinity of the spectral line, D: the first determination gives the value in carcels of the source studied; the ratio of the first to the second gives the degree of incandescence. I have shown† that if we compare two lights of different tints, the total intensities are in the same ratio as the intensities measured within the limits of the spectrum, the wave length of which is 582; thus it is very convenient and very correct to make photometric determinations by means of the trough 582; in fact, the two sources to be compared have not, as a rule, the same tints, and the solution 582 rendering them identical, the determination is more exact; the field of a carcel at 1 metre is too intense, and the interposition of the trough weakens it, so as to bring out very clearly in relief the slightest differences of the two luminous surfaces of the photometric screen.‡

As the employment of electric lamps and intense gas jets is becoming more and more general, the application of the method that I have proposed enables us to ascertain, without difficulty, the conditions of working of the lamps that give the best results.

A few examples will show the utility of these determinations:

For an arc lamp, the degree of incandescence varied from 1.5 to 1.7, the electric work§ absorbed being respectively 1,509 and 1,660 watts.

For a 16-candle incandescence lamp, this degree varied from 1.05 to 1.33, according as the lamp is more or less over-run.

For a Bourbouze lamp with a platinum hood, the degree of incandescence, which is less than unity for low outputs, increases with the consumption of gas and compressed air, and, at a sufficiently high *regime*, the degree of incandescence equals 1, which is that of the carcel.

The study of the Auer burner furnishes interesting results. The photometric power, the degree of incandescence and the consumption of gas in the lighting of the Auer burner that I used, gave the following results, which were taken from a considerable number of determinations:—

Luminuous intensities in carcels	4.42	5.23	5.35
Degree of incandescence	1.30	1.41	1.47
Consumption of gas, in litres per hour	93	105	102
Consumption in litres per carcel-hour	21	20	19

We see that the photometric power increases with the degree of incandescence, which is in accordance with the principles of the emission of radiations by incandescent bodies.

The consumption of gas per hour increasing, the degree of incandescence, low at starting, increases continually as well as the photometric power up to a certain limit, beyond which a part of the gas, which becomes more and more considerable, burns uselessly without contributing to the heating of the tissue of refractory earths that constitutes the hood of this burner; it is, therefore, advantageous to push the Auer burner to the degree of incandescence that it cannot exceed, whatever may be the consumption of gas for the lighting. The other intensifying burners may be studied in a similar manner and accurate data arrived at as to the best *régime* at which they should burn. The case is very different with gas burning in an ordinary Bengel burner.

In fact, in the Auer burner and other similar burners, the quantity of refractory material contained in the lamp is constant, and the maximum efficiency corresponds to the highest temperature that it can attain in a Bunsen burner. In the Bengel burner, on the contrary, part of the gas is burned outside and inside the cylindrical mass of gas which escapes through the crown of holes, without any deposit of carbon, with the production of a bluish flame, which may be disregarded from a photometric point of view; the high temperature which is produced by this combustion without effective light brings to incandescence the molecules of carbon given off from the carburets of hydrogen contained in the mass of gas comprised between the two surfaces of combustion, and which are the real source of light, as shown in my paper of photometry.*

The quantity of incandescent carbon that furnishes the light is a fraction of the total quantity of carbon that is contained in the gas in combustion, and is smaller in proportion as the flame is lower; if the latter is sufficiently low, the whole of the gas burns blue, without producing any effective light.

As the output of the burner increases the relative quantity of carbon liberated increases; the degree of incandescence slightly decreases and the luminous efficiency increases rapidly up to a maximum which corresponds to the moment when the flame becomes smoky. A similar result is obtained with the standard Carcel, the output of which is varied by raising or lowering the wick.

With the Bengel burner I employed I obtained the following results:—

Luminous intensities in carcels.	Comsumption of gas. In litres per hour.	In litres per carcel-hour.
.2	56	280
.4	78	195
.6	95	158
.8	108	135
1 0	120	120
1.2	131	100

Above 131 litres per hour the flame becomes smoky. From the above considerations, it follows:—

1. That, if we increase in a hydrocarburet burner the quantity of fuel burnt per hour, the luminous efficiency increases, but the degree of incandescence slightly diminishes up to a maximum efficiency, which must not be exceeded.

2. That for lamps in which the refractory material brought to incandescence has a fixed value independent of the consumption of combustible material, the maximum efficiency corresponds to the minimum quantity of combustible material that has to be burnt in order to obtain the maximum degree of incandescence.

---

* "Compte Rendu des Travaux du Congrès International des Electriciens en 1889," p. 210, in which will be found the explanation of solution 582.

† "Comparaisons Photometriques des Sources Lumineuses de Teintes Différentes. (*Comptes Rendus*, Vol. xciii., p. 512.)

‡ M. Pellin has constructed, according to my instructions, a sliding scale that can be adapted to any photometer, by means of which the indications can very conveniently be made.

§ The term *power* should be used instead of *work*, work being measured by joules and not by watts.

ELECTRICITY AT THE CYCLE SHOW.

The first national exhibition of cycles, cycle accessories and sundries is being held at Madison Square Garden all through this week. The exhibition was under the auspices of the National Board of Trade of Cycle Manufacturers.

Electricity plays a very important part in this interesting exhibition. The words "Bicycle Exhibition," made of incandescent lamps, appears on the outside of the building on the tower, to let the people know what is going on inside.

Inside, suspended from the centre of the large space is a beautiful chandelier composed of several hundred 16-c. p. lamps, the effect of which is to shed a remarkably brilliant light upon the floor below. At the extreme end of the garden over the Fourth avenue entrance are the words, in incandescent lamps, "First National Bicycle Exhibition, Under the Auspices of the National Board of Trade," surrounding a blazing figure of a bicycle also made of incandescent lamps of various colors. The wheels of this novel bicycle revolve and give a beautiful effect. The ceiling of the Garden is festooned with strings of lamps diverging from the centre.

A large number of the exhibitors have very effective electrical displays, one of the most prominent of which is that of the Monarch Cycle Company (No. 283–284), of which The C. F. Guyon Company, Ltd., 97 and 99 Reade street, New York, are the managers. They have at the back of their exhibit two large gold frames, showing two of their latest cycles fitted up with colored incandescent lamps. The lamps are distributed around the rims, under the frames and handles, and even the pedals have two incandescent lamps placed in front. The wheels of both cycles are kept revolving by electric motors placed under the frame. Two "monarchs of the jungles" had blazing lamps for eyes and a tongue rendered brilliant red by means of incandescent lights inside. Mr. C. F. Guyon is in attendance at the exhibit and is kept busy with a constant stream of visitors. He is assisted by a number of his salesmen, among them being Mr. L. F. Schnitzpahn. The company's sign in incandescent lamps, "Monarch Cycles," surmounts the two frames containing the living pictures of cycles.

The New York Standard Watch Company, of 11 John street, New York, is represented by exhibit No. 48. Among other things they have a large wheel, six feet in diameter, constructed of colored incandescent lamps. The wheel is made up mainly of their cyclometers and when it revolves it can be seen from every point of the Garden. One of their cycles is kept in motion by means of an electric motor, showing the operation of their celebrated cyclometer. Mr. F. Lutz is in charge of the exhibit.

The Gormully & Jeffery Manufacturing Company's exhibit, Nos. 120 to 125, is one of the main attractions of the show. It occupies the main space at one end of the Garden. Over the exhibit is the word "Rambler' in brilliant incandescent lamps. Mr. Gormully with his assistants are untiring in their efforts to entertain their many visitors.

The Hill Cycle Company, of Chicago, occupies space Nos. 14 and 15, and their exhibit is shown to the best advantage by the aid of incandescent lamps. At the back of the space is most artistically arranged drapery, studded with colored electric lamps. Mr. Frank F. Fowler represents the company and is full of enthusiasm in favor of the Fowler cycles.

The Tilman Magneto Dynamo and Lamp Company showed their little three-pound dynamo lamp and projector combination for bicycles. This combination can be attached to the front frame of the wheel. Connected with the dynamo is an arm holding a rubber pulley, which comes in contact with the inside rim of the front wheel. By this arrangement the dynamo is made operative. In riding the wheel, the light is projected 100 feet or more ahead. The company's trolley car projector lamp is also exhibited. It is claimed to be the best article of the kind in the market.

Dr. W. P. Freeman, the well known electrician, is found at the exhibit of the Newton Rubber Company, of Newton Upper Falls, Mass. He has on exhibition several of his improved primary-battery lamps and reflector combinations. This combination is designed for bicycles and weighs only one pound. The Newton Company has on exhibition their improved rubber tires. Dr. Freeman has lately completed machinery for making steels guard for use in protecting pneumatic tires.

The M. M. Electric Company, of 140 Washington street, New York, shows their new and improved primary battery lamp and reflector for bicycles, miners' and firemen's use. Dr Johnson of the company is kept busy at all times explaining the valuable and desirable features of this outfit.

J. C. Perriez, of the Columbia Rubber Co., 65 Reade street, New York, is present in the interests of the Palmer pneumatic tire. He shows how easy it was to repair this tire when it became punctured, and is evidently scoring several points for the Palmer.

The Hitchcock Manufacturing Co., of Cleveland, Ohio, attracts a great deal of attention to their exhibit in the basement, where they ran their motor cycles every hour. These cycles are run by two motors attached behind the rear wheel by means of an extra frame. Oil vapor is used for generating the power for driving these wheels. The oil is carried in a tank on the frame, the vapor being forced in the cylinders, compressed and ignited by electricity. The battery used for igniting is also attached to the frame. Mr. Francis C. McMillin looks after this exhibit.

Mr. Samuel K. Dingle, an old-time electrician, has a brilliant electrically-lighted exhibit of the Boston Woven Hose and Rubber Co., of 275 Devonshire street, Boston, Mass.

Mr. Alfred J. Thompson, well known in the electrical trade, looks after the interests of Louis Rosenfeld & Co., 20 Warren street, New York. This concern makes Hy-lo instantaneous changeable gears for wheels.

Mr. Hawkins, 136 Liberty street, New York agent of the Electrical Construction and Supply Co., Syracuse, N. Y., furnished the sockets and receptacles for all the 16-c. p. lamps used in the various exhibits. Over 3,000 of these lamps are in use.

Mr. Frank Martin is the electrician of Madison Square Garden, and prides himself on the illuminating effects produced.

THE CLEVELAND CONVENTION.

C. O. Baker, Jr., master of transportation of the National Electric Light Association, informs us that the Trunk Line Association has granted a rate of a fare and a third for round trip, on the certificate plan, for members and delegates attending the eighteenth convention of the National Electric Light Association, to be held in Cleveland, O., February 19, 20 and 21. Negotiations are now pending for a special train from New York to Cleveland, notice of which will be given as soon as route is selected and schedule arranged.

CORNELL IN THE LEAD.

An eminent European scholar, Professor Ritter, of Germany, who spent several months in this country, first at the Chicago Exposition and later studying American technical schools, has come to the conclusion that the Americans have outdone Europeans in the field of technological education, at least as regards its practical bearings. The technical branches are believed by Professor Ritter to be less complete and solid on the theoretical side in the United States than in Germany, but he sets opposite this inferiority the "truly grand achievements in engineering and machine construction in the United States. The Americans have not only mastered the technical sciences, mathematics and jurisprudence, but have given form to

distinct faculties of the sciences of engineering. So far as regards instruction in mechanical engineering, Cornell University, of Ithaca, N. Y., stands at the head of American institutes."—A. F. Weber's Cornell Newsletter.

NOLL & MACLEAN.

Augustus Noll and Howard A. MacLean have entered into partnership under the firm-name of Noll & MacLean, contracting electrical engineers, and have opened offices at 8 East 17th street, New York. Both Messrs. Noll & MacLean were connected with the New York Electric Equipment Company since its organization. Prior to this time Mr. Noll was the principal member of the firm of Noll Brothers, who had quite a reputation in the installation of lighting and power plants, and Mr. MacLean represented the Edison Illuminating Company of New York. He was one of the best known representatives of that company under the old Edison regime, when Mr. E. H. Johnson was at the head of the concern. Many of the largest isolated plants in this section were installed through the active agency of Mr. MacLean. Mr. Noll is widely known to the electrical trade as one of the most scientific wire men in the country. He is the author of the best book ever published on wiring, and his work during the past thirteen years stands as a monument his skill. The two named gentlemen form a strong team, both having had large experience. They each have an excellent reputation as a basis for their new enterprise, and we wish them every success.

THE FRANKLIN ELECTRICAL SOCIETY'S BANQUET.

The Franklin Electrical Society, New York, on the night of January 19, held its annual banquet in honor of the 189th anniversary of the birth of Benjamin Franklin. The banquet was held at Leon's, on West 31st street, and there was a large attendance.

President M. M. Mayer occupied the chair and the Hon. Franklin Grady acted as toastmaster.

Prof. W. W. Ker spoke of the society's achievements and recalled the earnestness of Franklin. The speaker referred to Franklin's patriotism and determination, and suggested that Franklin's spirit be embodied in the society's history.

Mr. Newton Harrison spoke on the career of the society, dwelling upon the difficulties of securing a foothold, and referred to the present system of lecturing from notes and the assured success it could claim.

Hon. F. Grady made the closing remarks in a happy and characteristic vein and the party then disbanded, after a most enjoyable feast of gastronomy and intellect.

Several prominent persons were the invited guests of the society.

ELECTRICAL STANDARDS.

Following is a copy of the order just issued in England specifying and describing the new standards of electrical measurements for use in trade :

Whereas by the Weights and Measures Act, 1889, it is among other things enacted that the Board of Trade shall from time to time cause such new denominations of standards for the measurement of electricity as appear to them to be required for use in trade to be made and duly verified.

And whereas it has been made to appear to the Board of Trade that new denominations of standards are required for use in trade based upon the following units of electrical measurement—viz. :

1. The ohm, which has the value 10^9 in terms of the centimetre and the second of time, and is represented by the resistance offered to an unvarying electric current by a column of mercury at the temperature of melting ice 14.4521 grammes in mass of a constant cross-sectional area and of a length of 106.3 centimetres.

2. The ampere, which has the value $\frac{1}{10}$ in terms of the centimetre, the gramme, and the second of time, and which is represented by the unvarying electric current which when passed through a solution of nitrate of silver in water in accordance with the specification appended hereto, and marked A, deposits silver at the rate of 0.001118 of a gramme per second.

3. The volt, which has the value 10^8 in terms of the centimetre, the gramme, and the second of time, being the electrical pressure that if steadily applied to a conductor whose resistance is one ohm will produce a current of one ampere, and which is represented by .6974 ($\frac{1000}{1434}$) of the electrical pressure at a temperature of 15 deg. C between the poles of the voltaic cell known as Clark's cell set up in accordance with the specification appended hereto, and marked B.

And whereas they have caused the said new denominations of standards to be made and duly verified.

Now, therefore, her Majesty, by virtue of the power vested in her by the said Act, by and with the advice of her Privy Council, is pleased to approve the several denominations of standards set forth in the schedule hereto as new denominations of standards for electrical measurement.

C. L. Peel.

SCHEDULE.

I. *Standard of Electrical Resistance.*—A standard of electrical resistance denominated one ohm being the resistance between the copper terminals of the instrument marked "Board of Trade Ohm Standard Verified 1894" to the passage of an unvarying electrical current, when the coil of insulated wire forming part of the aforesaid instrument and connected to the aforesaid terminals is in all parts at a temperature of 15.4 C.

II. *Standard of Electrical Current.* — A standard of electrical current denominated one ampere being the current which is passing in and through the coils of wire forming part of the instrument marked "Board of Trade Ampere Standard Verified 1894," when, on reverse ing the current in the fixed coils, the change in the forces acting upon the suspended coil in its sighted position is exactly balanced by the force exerted by gravity in Westminster upon the iridio-platinum weight marked A, and forming part of the said instrument.

III. *Standard of Electrical Pressure.*—A standard of electrical pressure denominated one volt being one-hundredth part of the pressure which, when applied between the terminals forming part of the instrument marked "Board of Trade Volt Standard Verified 1894," causes that rotation of the suspended portion of the instrument which is exactly measured by the coincidence of the sighting wire with the image of the fiducial mark A before and after application of the pressure, and with that of the fiducial mark B during the application of the pressure, these mages being produced by the suspended mirror and observed by means of the eyepiece.

(*To be Continued.*)

Notes of General Interest.

It is reported that the Cataract General Electric Company is endeavoring to secure the repeal of the law which authorizes the Superintendent of Public Works to grant franchises. It is stated that if this law is repealed that the Cataract Company would have an absolute monoply in the transmission and distribution of electric power along the Erie Canal.

Russell B. Harrison, president of the Citizens' Light and Power Co., Terre Haute, Ind., has begun suit in the Circuit Court against Edward S. Ellis and Charles Hilton to enjoin them from cutting down the electric light poles now being erected by the plaintiff. Messrs. Ellis and Hilton are officers of the Terre Haute Electric Light and Power Co., which held the contract for lighting the city for a number of years. The Citizens' Light and Power Co. recently got the contract and trouble between the two concerns has since existed.

WEST END COMPANY'S LOSS BY FIRE.

The West End Railroad Company's car house on Columbus avenue and Northhampton street, Boston, Mass., together with about 50 cars, were destroyed by fire on the night of January 16. The fire started shortly after midnight and for a time the large car house on Tremont street was threatened. The burned car house was a wooden building encased in corrugated iron and was 50x200 feet in size. The cars of the Columbus and Huntington street lines were kept here and they were all destroyed. The loss is about $100,000.

Telephone Notes.

The Tri-Village Telephone Company has been organized in Fort Edwards, N. Y., with a capital stock of $2,500.

A telephone line is to be built between Lumberton and McComb City, Miss.

Purvis and Columbia, Miss., are to be connected by telephone.

TELEPHONE PATENTS ISSUED JANUARY 15, 1895.

Annunciator for Telephonic Circuits. Theodore Spencer, Cambridge, Mass. (No. 532,605.)

Street Railway Notes.

The Connecticut House of Representatives has passed a bill providing that no steam railroad in the state shall be crossed by any electric, cable or horse railway at grade. It is stated that the object of the bill is to prevent the Bridgeport Traction Company from laying its tracks across those of the New York, New Haven and Hartford Railroad at the Fairfield avenue crossing.

The Gettysburg Electric Railway, Gettysburg, Pa., together with the electric light plant operated by the same company, has been sold to J. Luttrell Murphy, of Chicago and Walter B. Kendall and John S. Connelly, of Philadelphia, for $250,000. It is stated that the new owners will build and operate four miles of electric railway over the first day's battlefield, also twelve miles of road along the Baltimore turnpike.

J. Luttrell Murphy, of Chicago, and Walter B. Kendall and John S. Connelly, of Philadelphia, have purchased the Gettysburg Electric Railway, Gettysburg, Pa., and will extend the road's lines.

Possible Contracts.

W. J. Davidson, formerly superintendent of Starin's ship yard, New York, is building a large machine shop at Port Richmond, Staten Island.

The Bridgeport Traction Co., Bridgeport, Conn., has applied for permission to extend its lines to West Haven and Westport, and the Windsor Locks & Suffolk Railroad Company has applied for permission to extend its lines.

Final surveys are being made for the Queen Anne's Electric Railroad between Denton and Queenstown, Md. W. H. Bosley, of Baltimore, is president of the company.

The Rome Electric Street Railroad Co., Rome, Ga., contemplates making several improvements and additions. Mr. J. B. Marvin is manager of the road.

It is proposed to extend the lines of the Wilmington Street Railway Co., Wilmington, N. C, to Oakdale and Bellevue cemeteries. M. F. Heiskell is superintendent.

Geo. W. Pearce, Mississippi City, Miss., has received permission to build a car line in that place.

It is reported that a $200,000 electric light plant will be built in Birmingham, Ala.

The electric light and water-works in Troy, Ala., which is operated by the city, are to be overhauled and enlarged. The mayor of that place can give further information.

Mr. Robinson, of Orlando, Fla., is making an effort to secure an electric light franchise in that place. He can be reached in care of the Young Men's Business League.

The plant of the Newnan Electric Light and Power Company, Newnan, Ga., will likely be sold to the city, and negotiations with that object in view have been opened. The mayor of Newnan can give further information.

The Mount Washington Electric Light and Power Company, Baltimore, Md., has purchased a site for its new plant.

A company has been organized in Lumberton, Miss., to construct a telephone line from that place to McComb City.

A company has been organized in Purvis, Miss., to construct a telephone line from that place to Columbia.

An electric light plant is being constructed in Lewiston, Mo. Address the mayor for further particulars.

C. L. Warfield and others are seeking a franchise for an electric light plant in Dallas, Tex., to cost from $40,000 to $60,000.

The Lenoir City Car Works, Lenoir City, Tenn., has let the contract for an electric light plant.

An election is to be held in Cleveland, Tenn., on the question of issuing bonds for water-works and an electric light plant. Address the mayor for further information.

New buildings which may need electric plants are to be constructed in the following-named places: a brick depot for the Western Maryland Railroad Company, Baltimore, Md., to cost $25,000; school building, Baltimore, Md., address Geo. Worthington of that city for particulars; a Masonic temple, Columbia, Ga., address the secretary of the Masons for further information; building in Gainesville, Tex., for the South-Western Telephone Company, Galveston, Tex.; King Opera House, by T. H. King, Greenville, Tex., to cost from $35,000 to $40,000; warehouse, to cost $150,000, by the Cupples Real Estate Co., St. Louis, Mo.

The Annapolis, Md, City Counsel has granted the Annapolis & Bay Ridge Electric Railroad Co. the right to lay tracks on several of the streets of that city. Henry Y. Bready is engineer.

New Corporations.

W. J Davis Electric Co., Pittsfield, Mass., by Jacob Gimlich, president, Wm. P. Wood, treasurer and W. J. David.

The Tri-Village Telephone Co., Fort Edwards, N. Y. Capital stock, $2,500.

The Tillimook Electric Railway Power and Lighting Co., Salem, Ore., by W. H. Cary, David Hess and William Squires. Capital stock, $500,000.

La Salle Construction Co., Chicago, Ill., by W. E. McClurg, Bumstead and F. S. Donnell. Capital stock, $100,000.

The Westport and Southport Electric Railroad Company has been organized in Bridgeport, Conn., to operate lines in Weston, Southport and Fairfield.

The Dravosburg & Elizabeth Electric Street Railway Co., Dravosburg, Ohio, by H. W. Juergen and others. Capital stock, $40,000.

The Economy Street Railway Co., Baden, Pa., by Hartford P. Brown and others. Capital stock, $3,000.

York Haven Water & Power Co., York Haven, Pa., by Henry L. Carter and others. Capital stock, $2,000.

The Cartersville Light & Power Co., Cartersville, Ga., by P. W. French, F. P. Sydmonds, W. F. Merrill and others Capital stock, $100,000.

The Nantucket Electric Co., Nantucket, Mass., by Fred. H. Potter, president, John R. Bacon, treasurer and W. A. Clark, Jr. Capital stock, $20,000.

A company is being formed in New London, Conn., with a capital stock of $200,000, to construct an electric road between that city and Norwich.

Milwaukee Dynamo Company, Milwaukee, Wis., by W. A. Ehlman, John Keorts and Theodore Egelhoff. Capital stock, $15,000.

Staten Island Terminal Electric Railroad Co., New Brighton, Richmond County, N. Y., by Herman Bergholtz and others. Capital stock, $50,000.

The Associated Water, Gas & Electric Light Co., Nevada, Mo., by F. J. Tygard, of Butler, as President, and C. F. Stratum, secretary and treasurer.

Bourdreaux Dynamo Brush Co., Chicago, Ill., by Hugo Benedix, Arthur Nollan and James J. Hoch. Capital stock, $25,000.

State Harrison Telephone Construction Co., Chicago, Ill., by James H. Talbot, Harry L. Talbot, William R. McLaren and John F. Talbot Capital stock, $150,000.

Newman, Canning & Electric Light Co., Newman, Ill., by R. Thomas, Joseph Vandine, L. E. Root, W. J. G. Pound and J. H. Scotten. Capital stock, $14,000.

The County Electric Light and Power Co., Clayton, Mo., by M. B. Greensfelder, E. W. Warfield, E. H. Benoist, C. K. Ramsey and others. Capital stock, $5,000.

The St. Louis County Telephone Company, Clayton, Mo., by M. B. Greensfelder, E. W. Warfield, O. H. Benoist and others. Capital stock, $5,000.

New York Notes.

Office of the Electrical Age,
World Building, New York,
January 21, 1895.

The Board of Electrical Control has authorized the issue of temporary permits for placing overhead wires in streets where there are no subways.

Mayor Strong has issued an order to the effect that street railroad companies in the future must sign a written application for permission to use snow plows or sweeping machines in removing the snow from their tracks. The railroad companies must also, in their application, agree to remove from the streets all snow swept from the tracks and to clean the streets of snow for three feet on each side of the tracks. It is stated that the Mayor will revoke the permit of any company failing to comply with the conditions imposed by this order. There are several applications from street railroad companies for permission to use snow plows and sweepers, but the Mayor will not issue them till the companies agree to the conditions of the order above referred to. So far two companies have signed the applications under the new conditions.

The New York Electric Equipment Company is moving its offices from Duane and Elm streets to the factory of the General Incandescent Arc Lamp Company, 572 First avenue, city.

The Third Avenue Railroad Company has just received a large spool containing a new cable, which will be laid down in the conduit. The cable is 19,500 feet in length and 1½ inches in diameter. It will run from the Post-Office to Sixth street and back. The cable and spool together weigh nearly forty tons, the spool being ten feet in length and ten feet in diameter.

Mr. J. H. Waterman, formerly of the export department of the International Thomson-Houston Electric Co., has taken the management of the export department of the Fort Wayne Electric Corporation, at 115 Broadway, city. Mr. Waterman lately returned from Caracas, Venezuela, where he installed a large T. H. plant for the Compania del Gas y Luz. He is very popular in the foreign trade and a pleasant gentleman to know. The Fort Wayne Corporation is fortunate in securing his services.

The annual meeting of the Edison Electric Illuminating Company, of New York, was held at the company's offices on Duane street on January 15. The annual report shows earnings of $1,369,066; other sources of income, net, $124,443; operating expenses, $550,426; net earnings, $789,466. During the year $476,196 were paid in dividends. The following named directors were elected for the ensuing year: A. H. Boissevain, R. R. Bowker, C. H. Coster, C. E. Crowell, Thomas A. Edison, W. E. Glyn, D. O. Mills, George F. Peabody, W. A. Read, F. S. Smithers, and Spencer Trask. W. T. H.

Trade Notes.

The LaRoche Electrical Works, of Philadelphia, have gone into liquidation, Mr. F. A. LaRoche succeeding to the business. We understand that the concern was in a solvent condition and went into liquidation in order to dissolve the business.

Mr. H. C. Willis, of the Washburn & Moen Mfg. Company, 16 Cliff street, New York City, is doing a large business in insulated and bare copper wires for all electrical purposes. He recently closed an order for 2,000 feet of 2,000,000 c. m. cable, composed of 127 No. 10 Stubbs gauge wires. The copper cable alone is 1⅝ inches in diameter. It is covered with pure rubber, on top of which is laid black rubber and it is then braided to a size 2¼ inches over all. Orders like this are common with Mr. Willis. He recently filled one for 80 miles of weather-proof wire.

F. R. Chinnock, Havemeyer Building, New York City, the well-known electric light and railway contractor, has secured the contract to install an electric light plant in the new building of the Curtis Estate, Buffalo, N. Y. The plant will include two 30 K. W. Fort Wayne Electric Corporation dynamos and one 250 H.P. vertical engines made by the Lake Erie Engineering Company. The switchboard for this plant will be a handsome one, of marble, and will be fitted with one Keystone voltmeter, two Keystone ammeters, ten knife switches, one break-down switch and two iron-clad rheostats. Mr. Chinnock will have as his assistants a corps of well-known electricians, including Mr. J. F. Hadley, late of the New York Electric Equipment Company; W. S. Lawton, late of the Edison Illuminating Company, of Brooklyn, N. Y., and D. F. Merrill. Mr. Chinnock, himself, will supervise the work. He does electric light work as well as electric railway. Mr. Chinnock will finish the electric railway plant in Hackensack, N. J., when spring opens.

WOVEN WIRE BRUSHES.

The Belknap Motor Co., of Portland, Maine, are the patentees and manufacturers of the best woven wire commutator brush on the market.

Oratavo, in the Canary Islands, is lighted by electricity generated by water-power. The plant was supplied by a Swiss firm.

Underground Feed Wires.—The West End Street Railway Co., of Boston, Mass., is laying its feed wires underground. This work involves a cost of about $400,000.

Electrical and Street Railway Patents.

Issued January 15, 1894.

532,441. System of Power Transmission. Charles S. Bradley, Avon, N. Y. Filed Sept. 12, 1893.

532,448. Conduit Railway-Trolley. William T. Dulany, Jr., New York, assignor of one-half to Oscar F. Shaw, Brooklyn, N. Y. Filed Mar. 30, 1894.

532,449. Conduit Electric Railway. William T. Dulany, Jr., New York, assignor of one-half to Oscar F. Shaw, Brooklyn, N. Y. Filed Aug. 16, 1894.

532,475. Brake for Electric Motors. William H. Morgan, Alliance, Ohio, assignor of three-fourths to Thomas R. Morgan, Sr., Thomas R. Morgan, Jr., and John R. Morgan, same place. Filed Mar. 19, 1894.

532,477. Trolley-Catcher. Martin V. B. Nichols and James A. Fraser, Port Arthur, Canada. Filed May 26, 1894.

532,514. Electric Elevator and Motor Controller. Robert Wilson, Louisville, Ky., assignor to the Sulzervogt Machine Company, same place. Filed June 23, 1894.

532,531. Electric-Arc Lamp. Arthur Chester and John J. Rathbone, London, England. Filed Mar. 26, 1894.

532,538. Controller for Electric Cars. Harry P. Davis, Pittsburgh, Pa., assignor to the Westinghouse Electric and Manufacturing Company, same place. Filed Apr. 14, 1894.

532,549. Alternating-Current Motor. Ludwig Gutmann, Pittsburgh, Pa. Filed Aug. 27, 1890.

532,559. Galvanometer. Adrian H. Hoyt, Penacook, N. H., assignor to the Whitney Electrical Instrument Company, Saco, Me., and Manchester, N. H. Filed Apr. 25, 1894.

532,560 Galvanometer. Adrian H. Hoyt, Penacook, N. H, assignor to the Whitney Electrical Instrument Company, Saco, Me., and Manchester, N. H. Filed Apr. 25, 1894.

532,561. Galvanometer. Adrian H. Hoyt, Penacook, N. H., assignor to the Whitney Electrical Instrument Company, Saco, Me., and Manchester, N. H. Filed Apr. 25, 1894.

532,566. Car Fender. Joseph J. De Kinder, Philadelphia, Pa. Filed Nov. 27, 1893.

532,576. Closed Conduit Electric Railway. George W. McClintock, Wollaston, and Daniel J. McLane, Quincy, Mass. Filed July 2, 1894.

532,588. Contact Device for Electrical Appliances. Friedrich W. Schindler-Jenny, Kennelbach, Austria-Hungary. Filed Feb. 19, 1894 Patented in Austria-Hungary Nov. 2, 1893, No. 66,076 and No. 9,799; in France Nov. 10, 1893, No. 233,957; in Belgium Nov. 11, 1893, No. 107,-135, and in Italy Nov. 30, 1893, No. 35,280/173.

532,590. Closed-Conduit Electric Railway. John Schnepp, New York, N. Y., assignor of one-half to William H. Bellamy and William C. Doscher, same place. Filed Sept. 9, 1893.

532,593. Converter System for Electric Railways. Chas. F. Scott, Pittsburgh, Pa, assignor to the Westinghouse Electric and Manufacturing Company, same place. Filed July 31, 1893.

532,594. Non-Arcing Switch. Charles F. Scott and Harry P. Davis, Pittsburgh, Pa, assignors to the Westinghouse Electric and Manufacturing Company, same place. Filed Mar. 29, 1894.

532,605. Annunciator for Telephonic Circuits. Theodore Spencer, Cambridge, assignor to the American Bell Telephone Company, Boston, Mass. Filed Sept. 10, 1894.

532,610. Car-Fender. Edward K. Thoden, Brooklyn, N. Y. Filed May 23, 1894.

532,621. Brake for Railway Cars. David L. Winters, Pueblo, Colo. Filed May 19, 1894.

532,662. Electric Switch. William P. Hancock, Everett, Mass. Filed Nov. 27, 1894.

532,683. Car-Fender. Andrew Mohn and August J. Bothur, Hoboken, N. J. Filed Aug. 30, 1894.

532,701. Mechanism for Forming Battery-Plates. Chas. J. Reed, Philadelphia, Pa., assignor to the Reed Electric Company, same place. Filed Sept. 12, 1894.

ELECTRICAL AGE

VOL. XV., No. 5. NEW YORK, FEBRUARY 2, 1895. WHOLE No. 403

ESTABLISHED 1883.

Entered at New York P. O. as second-class matter, January 18, 1891.

THE ELECTRICAL AGE PUBLISHING CO., PUBLISHER

TERMS OF SUBSCRIPTION:

One Copy, one year,	$3.00
One Copy, six months,	1.50
Great Britain and other Countries,	4.00

Cable Address (all Cables,) "Electage," New York.

W. T. HUNT, President. F. N. BASSETT, Vice-President.
T. R. TALTAVALL, Secretary and Editor.
NEWTON HARRISON, E. E., Scientific Editor.

ADDRESS ALL COMMUNICATIONS TO
THE ELECTRICAL AGE PUBLISHING COMPANY,
FIRST FLOOR, WORLD BUILDING.
NEW YORK.

NEW YORK, FEBRUARY 2, 1895.

CONTENTS.

ELECTRICITY AT PUBLIC EXHIBITIONS.

A great measure of the success of the cycle show at Madison Square Garden last week was, no doubt, due to the agency of electrical decorations. Indeed, no enterprise of this character could be made a success without the aid of electricity. The dazzling electric light attracts people, and the artistic electric decorations and devices excite admiration and a desire to see more. The electrical displays at the exhibition were truly ingenious and attractive, and there is no better way to popularize electricity in all its applications than to demonstrate on such occasions as these what can be done with it. The masses would go to a bicycle show, a horse show, or a poultry show, rather than to an electric display, pure and simple.

THE SOUTH NORWALK ELECTRIC LIGHT PLANT.

The municipal electric light plant of South Norwalk, Conn., is generally recognized among advocates of municipal control of such plants as a model. This plant is conducted on purely business principles and the commissioners are untrammeled by politics in the discharge of their duties. The plant is operated just as it would be if it were in the hands of a private concern, and what advantage is gained by this method of control is credited to the taxpayers, who are virtually the shareholders in the enterprise. The South Norwalk plant is successful because politics is a minus quantity in its administration, and because practical men constitute the Board of Commissioners. We illustrate and describe this plant on another page, and give some figures in connection therewith that will be interesting to our readers.

THE BROOKLYN STRIKE.

The Brooklyn street railroad companies have accomplished a great deal during the past week towards re-establishing full service on their lines. On Monday of this week the First Brigade of the New York State National Guard returned to their headquarters in New York city. This was done on the supposition that the strike was practically over, and that the police and Second Brigade could cope with any violence that might occur. This feeling of safety, however, was not well founded. As soon as the troops turned their backs on the "City of Churches" the strikers, or their sympathizers, renewed their attacks upon the railroad companies' property. They stoned cars, cut wires promiscuously, and did all the damage they could. There were several casualties of a more or less serious nature in consequence. The strike, however, is practically ended. Full service is about resumed, and things are gradually settling down to their normal condition. Cases of violence continue, but they are rapidly decreasing in number. On Monday last the strikers offered to return to work at the old wages, but the railroad companies paid no attention whatever to the propositicn. It is stated that the purpose of this move was to catch the railroad companies in order to gain a legal hold upon them, but the companies would not bite. The strikers, however, are actively engaged in preparing writs, mandamuses, etc., and their legal representatives are already in Albany for the purpose of bringing proceedings to annul the charters of the companies involved. On Tuesday the strikers' counsel applied for peremptory mandamuses to compel the companies to operate their cars on all their roads forthwith, but owing to a technical error Justice Gaynor returned the papers. The application was to have been again presented on Wednesday.

A TEST OF A 65-H. P. MOTOR.

BY THOS. J. FAY.

Ordinarily when tests of motors are made, no mention is made of the losses outside of the motors being tested, and on this account the commercial importance of such tests is limited. The following record of a test has several important bearings, especially on the commercial aspect, and on account of the peculiar conditions met with this record is considered by the author well worth its publication.

The arrangement of the accompanying diagram, to begin with, is something unusual, if indeed, not quite new, and it commends itself amongst other features for the facility of showing:

(a) The loss in the motor running free.

(b) The loss in shafting and machinery (doing no useful work).

(c) The useful work.

(d) The loss in transmission.

Each of these several losses are represented on the diagram or chart by their respective areas, while the chart also shows the variations in the load, as well as the variation in the line loss. In this case the motor was situated 8,000 feet from the generator, and was connected up to the generator by two sets of 00 B & S gauge wire. The motor was rated at 107½ amperes of current at 500 volts E. M. F. influx, with which expenditure of energy it gave out on its pulley 65 B. H. P. in useful work, making the efficiency of the motor at full load

$$\frac{48520}{54450} = 90 \text{ per cent. about} = \frac{\text{watts output.}}{\text{watts applied.}}$$

In the make up of the chart it may be seen that the abscissæ represent E. M. F. in volts and the ordinates represent current in amperes. The observations were taken both for the ampere readings of the motor and simultaneously for the volts wasted in transmission, the motor being operated at a constant E. M. F. of 500 volts—and since a length × a breadth = an area, and the length is to scale in amperes and the breadth is to scale in volts, the area of the whole chart represents the total output of the generator in watts, E × C = W = 569 × 108.9 = 61.964 watts. This being the case the whole area represents the total output of the generator. It also follows that by the arrangement of the chart we may find the respective areas of the several divisions. For instance, the loss in the motor running free is 500 × 5.5 = 2,750 watts. On the same basis all the other quantities may be represented.

A summary of the quantities under consideration is given below:

Output of generator..........	108.9 × 569	61,964	
Loss in motor (fixed)........	5.5 × 500		2,750
Loss in motor (variable)......	6.18 × 500		3,180
Friction loss of shafting and machinery................	68.14 × 500		34,070
Useful load..................	28.9 × 500		14,450
Loss in transmission..........	108.9 × 69		7,514
Total power generated and used		61,964	61,964

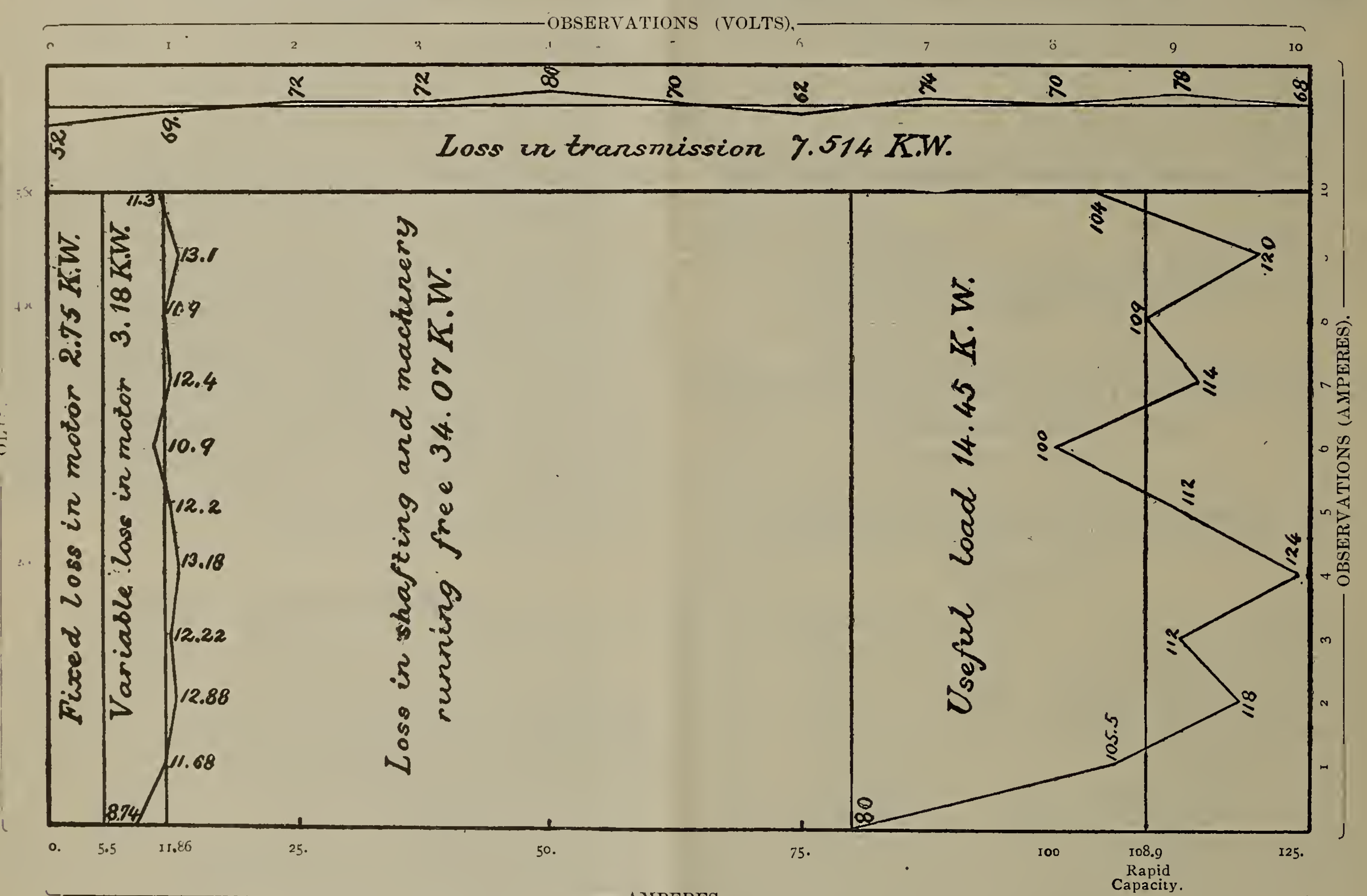


CHART SHOWING THE PERFORMANCE OF A 65-H. P., 500-VOLT MOTOR, RECEIVING CURRENT FROM A CENTRAL STATION.

We also glean from the chart the further information that the

Maximum load in amperes was................	124
Maximum difference of potential was..........	580
Minimum load in amperes....................	80
Minimum difference of potential in volts was...	552
Average load in amperes was................	108.9
Average difference of potential in volts was.....	569

We may go further and determine that the loss in the

motor free was................................	4 %
The loss in the motor loaded was................	10 "
The loss in the transmission system was..........	12.1 "
Loss in shafting and machines was...............	55 "
Useful load was................................	23 "

From an inspection of the above percentages one would get the idea that the commercial efficiency of the system as employed in this case is low, since from the efficiency formula we get

$$\text{efficiency} = \frac{\text{output}}{\text{influx}} = \frac{\text{useful work}}{\text{whole work}} = \frac{14.45}{61.96} = 23.3\%$$

It is not a fact, however, that this low efficiency is due to the bad quality of the electrical equipment; on the contrary, it is due to the great loss in belts and shafting employed in this plant. The chart shows that 55 per cent. of the total power is lost in the dead load of the mechanical transmission. It is a fact, however, that the loss in transmission is in excess of good economy, because, as the following deduction will show, no regard was paid to the relation which first cost bore to cost of maintenance. The power in this case sold for $60 per 3,000 horse-power hours of 746 watts, and at this rate the loss in transmission was worth $120 per year per h. p. of 746 watts, the mill being operated over 18 hours per day. Therefore the value of the power lost in transmission was :

$$\frac{7,514 \times 1000}{746} \times 120 = \$1200.$$

We have to balance against this the cost of maintenance of the system, and

$$\$ = \frac{A \times F^2 \times c}{V \times 746,000.} = \$1668, \text{ cost of copper}$$

$\$$ = cost of copper in the system
F^2 = the square of the distance in feet
c = cost of copper per pound
V = loss in volts

to which must be added $500.00 cost of poles, insulators, labor, etc., in erecting the line, so that the total cost of the transmission system would be

copper	$1,668.00
poles, fitting and labor	500.00
cost of system	$2,168.00

Assuming interest and depreciation at 10 per cent. on $2,168, the cost of maintenance would be $216.80 as against $1200.00—the value of the power wasted in transmission. From the above it is easy to see that by doubling the cost of copper, thereby making the loss one-fourth that of which it was, the added copper would be but a little in excess of the best possible result. Under these assumed conditions of economy

Present cost of copper × 2 = 1668 × 2 =	$3,336.00
Cost of poles, fittings and labor × 1.5 = 500 × 1.5 =	750.00
Total cost of transmission system	$4,086.00

And again at 10 per cent. for interest and depreciation, the cost of maintenance of the line would be $408.60 as against $216.80—the actual figure; but the value of the power lost would be under the increased first cost,

$$\frac{\$1200.00}{4} = \$300.00$$

A summary of the whole would show,

present cost of maintenance.......	$ 216.80	
present value of power lost........	1200.00	
as it should be, cost of maintenance,		$408.60
as it should be, value of power lost,		300.00
	$1,416.80	$708.60
saving under assumed conditions..		708.20
	$1,416.80	$1,416.80

Inasmuch as to effect this saving of $708.20 it is necessary to increase the first cost $1,818.00, we can assume the investment to be a dividend payer in the amount of 40 per cent. per annum. The increased first cost would, therefore, be entirely covered by dividends in 2½ years. Consequently, from what has been said, we can safely reach the following conclusion:

(a) The cost of the transmission system could be nearly doubled advantageously.

(b) The economy of the motor is very good.

(c) The loss in belts, shafting and machinery doing no work is abominable.

(d) The net commercial efficiency on account of line losses and a bad mechanical transmission system is fully 50 per cent. below that easily realized in a well established system.

Finally, charts of the nature of that herewith considered are certainly worthy of serious consideration. It is not generally known that so much valuable data can be so concisely arranged in any other way, and even in this case the author has not reached the limits of the usefulness of the chart.

For instance, the chart shows that the motor was overloaded maximum 16.5 amperes; average 1.4 amperes, and just as clearly to a close observer the chart has other significant values, which on the whole would permit one to conclude that this chart is to the electric motor what the indicator card is to the steam-engine. The chart, however, is easier of comprehension.

THE ELECTRIC LIGHT IN LANTERN PROJECTION.

On the night of January 22, Mr. Edward Powell Hopkins delivered a lecture before the New York Electrical Society on "The Electric Light in Lantern Projection."

The meeting, which was well attended, was held at Columbia College. A large number of ladies were present.

Mr. Hopkins, who is a well-known lantern expert, first described, with the aid of diagrams thrown on the screen, the principles of lantern projection. He next dwelt upon and illustrated the effect of lenses in the distribution of light rays, and pointed out the importance of a correct arrangement of lenses in lanterns.

The subject of dissolving views next received his attention, and afterwards he used a microscopical attachment, throwing upon the screen parts of the anatomical structure of an ordinary fly, magnified to 3000 diameters.

Mr. Hopkins closed his interesting lecture by illustrating the effect on the arc of change in current and voltage, the image of the voltmeter being projected on the screen so that the readings under the changed conditions of current could be noted by the audience.

The lecture throughout was extremely interesting, and some fine lantern views were shown during the course of the remarks.

A COMPLIMENT TO MR. RICHARDSON.

An incident of the Brooklyn strike last week was the proposition by the strikers to the railroad companies to submit their differences to Mr. Wm. J. Richardson for arbitration. In their petition to the presidents of the railroads the strikers referred to Mr. Richardson as having 27 years' experience in railroad affairs, and as a person to whom they would unconditionally submit their grievances for adjustment in accordance with the resolution of their executive committee.

The railroad presidents, however, claimed that they had nothing to arbitrate, therefore the efforts of the strikers in this direction were unsuccessful.

The compliment paid Mr. Richardson is a high one, and it shows that he is held in esteem by the employés of the railroad companies. If more of such confidence had existed between employers and employés, perhaps the strike would not have occurred.

The Century Telephone Company, Peekskill, N. Y., has applied to the Peekskill authorities for permission to erect poles in the streets of that place for a telephone service.

PRINCIPLES OF DYNAMO DESIGN.

BY

Newton Harrison, E.E.

(*Continued from Page 52.*)

The last remarks rather suggested the possibility o there being impurities in the steel tending to affect its permeability; not only is this fact of consequence to foundry owners, who desire to supply the trade, but a more exact knowledge is of equal importance to the designer. By knowing the foreign elements that enter into its composition, the possibility of eliminating or reducing the one of greatest detriment to its high magnetic conductivity can, by proper experiment, be correctly determined. A series of tests have been performed by Max Osterberg and Melbourne Monroe, relative to the above matter, with satisfactory results. One sample of the steel contained less carbon, manganese, phosphorus and silicon than the other, but the same amount of sulphur.

The samples were treated to four processes: annealing, hardening and annealing, hardening and plain. The tables they obtained by their experiments gave the values

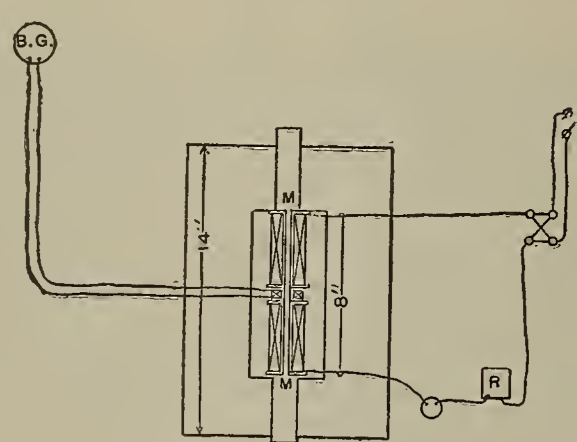


FIG. 20.

of the specific induction per square centimeter, the permeability, strength of field and flux per square inch.

The apparatus for determining the quantities about to be given consisted of a rectangular magnetic circuit through the centre of which the bar to be tested, but cut in half, was placed; a small coil surrounded the bar at the middle, a greater coil on each side of it, and a spring was so adjusted that upon the removal of the upper portion of the bar the coil flew out, cutting all the lines of force in its path.

A d'Arsonval ballistic galvanometer, ammeter and various resistances completed the outfit. The greater coil, called by the experimenters, the primary, consisted of from 900 to 2,000 turns with a range of current varying from .07 to 6 amperes. The secondary was composed of 90 turns wound on an appropriate spool and properly attached to the spring. The sketch shows the general principle of connections, magnetic circuit, etc. (See Fig. 20.)

The quantitative results of these tests for both samples are given below. The phosphorus and sulphur in all probability have very little effect upon the permeability, the quantities being very small. Therefore, those materials having the greatest effect may be rightly considered as the tables carbon, manganese and silicon. (See tables.)

The peculiar conclusion reached seems to be that impurities in wrought iron at low saturations are not as severe in their effects upon the permeability as at high ones, while impurities in steel under the same conditions cause the opposite effect. The unbalanced condition of the molecules of mild steel unfortunately make it sensitive to the slightest external changes and render a careful test absolutely necessary.

Carbon, which determines the quality of steel by the amount present aside from its magnetic properties, has an immediate effect upon the permeability; the greater the amount of carbon the less the permeability, and the converse. Hopkinson and Ewing have made interesting tests of the results of various chemical compositions in steel; and make decided mention of the effect of manganese and silicon upon its magnetic output.

The next point to consider in an examination of this subject is the effect of temperature upon steel. Castings of either iron or steel are subjected to a sudden change of temperature when being poured which change must have some immediate effect upon either their physical or chemical constitutions or both. Cast iron, as is well known to all of even limited experience with it, possesses a skin or scale of almost diamond-like hardness; it is, of course, true that the chemical constituents contained in the iron as silicon, etc., have a great bearing upon this condition, but the

A—BASIC OPEN HEARTH STEEL COMPOSITION.

Carbon .07		B = Lines force per sq cm.
Manganese .22		B'' = " " " inch.
Phosphorus .008		$H = B \div \mu$.
Sulphur .032		μ = permeability.
Silicon .053		

ANNEALED 10 *S*. / PLAIN.

	B	μ	H	B''	B	μ	H	B''
1	9,110	1,052	8.67	58,760	11,466	927	124	73,956
2	11,498	929	12	74,162	13,883	362	38	89,546
3	14,626	197	74	94,338	14,721	238	62	94,950
4	15 992	129	124	103,148	16,114	130	124	103,935
5	17,852	72	248	115.145	17,943	72	249	115,732
6	19.526	53	369	126,007	19,616	51	384	126,523
7	21,693	35	620	139,920	21,630	35	618	139,514
8	22,592	30	753	145,718	22,506	30	750	145,164

HARDENED AND ANNEALED, 10 *HS*. / HARDENED, 10 *H*.

	B	μ	H	B''	B	μ	H	B''
1	11,219	1,007	11	72,363	5,422	438	12	34,972
2	13,574	488	28	87,552	13,387	361	37	86,346
3	14,689	237	62	94,743	15,000	20	74	96,750
4	15,371	160	96	99,143	16,177	131	124	104,432
5	16 052	115	139	103,535	18,253	74	247	117,732
6	16,982	85	200	109,534	20,948	42	499	135,114
7	21,631	42	515	139,520	22,066	36	613	142,326
8	23,341	31	753	150,549	22,655	30.5	743	146,125

B—ACID OPEN HEARTH STEEL COMPOSITION.

Carbon	1,406
Manganese	470
Phosphorus	.032
Sulphur	.032
Silicon	.077

ANNEALED, 140 *S*. / PLAIN, 140.

	B	μ	H	B''	B	μ	H	B''
1	4,401	395	11	28 386	3,946	319	12	25,452
2	7,685	363	21	49,508	8,863	239	37	57,166
3	9,607	265	37	61,965	10,165	164	62	65,564
4	11,403	128	89	73.549	13,078	106	123	84,353
5	12 520	94	133	80,754	15,080	61	247	97,266
6	14,008	56	250	90,351	16,444	44	374	106,064
7	17,757	35	507	114.533	17,665	36	490	113,939
8	18,904	31	610	122,931	20,050	27	743	129.323

HARDENED AND ANNEALED, 140 *HS*. / HARDENED, 140 *H*.

	B	μ	H	B''	B	μ	H	B''
1	7,996	323	25	51,574				
2	11,498	186	62	74,162	4,550	92	49	29,348
3	13,203	107	124	85,159	8,554	69	124	55,173
4	14.972	60	250	96,569	11,682	47	249	75,349
5	16,735	45	372	107,941	13,426	36	373	86,598
6	17,807	36	495	114,855	15,060	30	502	97,137
7	19,090	31	616	123,131	16,152	26	621	104,180
8	20,203	27	748	130,309	17,231	23	749	111,140

sudden cooling of the outer surface of the molten mass when coming in contact with the cool, moist sand has an additional effect of perhaps equal importance. The chemical change may be greatly due to this sudden reduction of temperature and this, if it does not entirely alter the characteristics of the metal, will at least do so to such an extent that we would have to pass through at least five per cent. of the outer surface before the normal metal is reached. Very small castings of iron, if thin, will have an impenetrable hardness sufficient to turn the point of any drill, which condition may occur to a lesser extent in steel castings, though being most evident near the outer surface. Any process tending to suddenly cool the metal

will have this effect of altering its permeability, or any tending to change its hardness (annealing), by which these conditions can be very effectively removed, will raise the permeability to a much higher point, though it is not considered worth while by a great majority of manufacturers.

In testing a sample of steel and subjecting it to a variety of temperatures, a certain *critical temperature* is reached at which the permeability becomes unity. As the thermal conditions become severer at a small magnetization, the permeability curve mounts very rapidly. When a certain high permeability has been reached, a rapid change occurs and the conductivity of the iron drops, becoming no better than air. It is a common laboratory experiment to immerse a sample of steel in paraffine, gradually raise its temperature and note the changes with a magnetometer. The agitation of the molecules of iron or steel when heated to a state approaching liquefaction may be so great as to remove the possibility of polarizing it to any extent; it would be merely a test of the internal molecular forces against an external magnetizing force.

A set of valuable curves taken from Dugald Jackson's

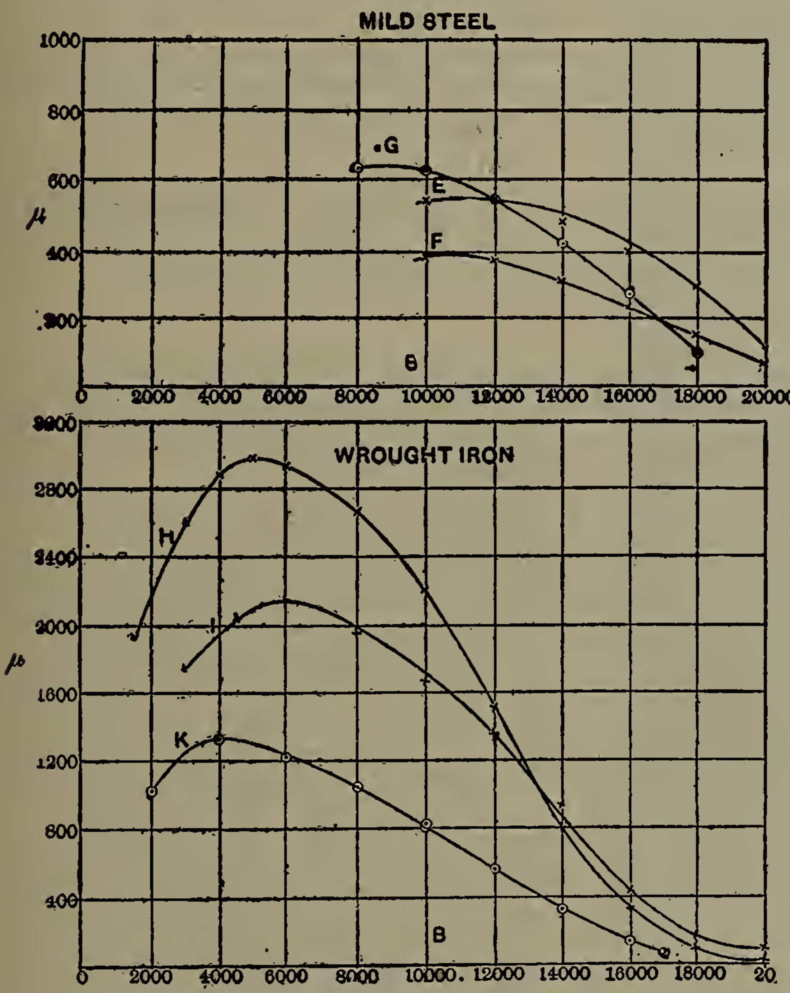


FIG. 21—PERMEABILITY CURVES, SHOWING EFFECTS OF VARIOUS IMPURITIES.

"Electro-Magnetism," for mild steel and wrought iron are given below, these metals containing the following constituents:

	C	Si	Mn	P	S
Curve E. Steel casting capable of tempering and welding	.40	.08	.18	.04	.017
Curve F. Steel casting capable of tempering and welding	1.13	.09	.19	.04	.015
Curve G. Test piece of Whitworth's mild steel..........	.32	.04	.44	.035	.017
Curve H. Average from these test pieces.	.08	.03	.01	.03	.01
Curve I. " " " merchant wt. iron	.075	.10	.25	.10	.10
Curve K. A sample of Mitis metal (aluminum present)..					

The general result of all these observations seems to be:

(1) The chemical composition of steel alters its permeability.

(2) Temperature changes greatly alters its permeability, bringing on

(3) Both physical and chemical changes.

There is one more factor which has a very great influence upon the conductivity of steel referred to before and that is, blow-holes. Mild steel is very subject to this trouble, and out of ten samples, perhaps, but two will be comparatively free from this defect. It seems as if the condition of the steel greatly depended upon the fact of its being either first, last or middle lot in the flow, the first and last being very apt to contain the greater percentage of impurities and therefore leading us to expect more unsound steel in castings taken from that portion of the metal.

(*To be Continued.*)

SOUTH NORWALK'S MUNICIPAL ELECTRIC LIGHT PLANT.

Among the electric light plants controlled by municipalities, perhaps none is better known than that operated by the city of South Norwalk, Conn. This plant is looked upon as probably the best example of a municipal plant that can be found anywhere in this country. It has been demonstrated in this case that an electric light plant can be operated by municipal authorities to the decided advantage of the taxpayers. The advantages, of course, are represented in the less cost for a given quantity of light, and it has been proved beyond question that the citizens of South Norwalk are getting their street light at much less cost to themselves than if the same light were bought from private parties. The reason for this is obvious—a private concern runs the business for profit, while a municipality saves the profit for the taxpayers.

The South Norwalk plant is run strictly on business principles, and therein lies the secret of the success attained in this case. Politics do not enter into the composition of the Board of Commissioners at all.

SOUTH NORWALK ELECTRIC LIGHT PLANT.

The plant was built by the city under the direction of Mr. Albert E. Winchester, who designed and planned it, and who was appointed consulting engineer by the committee having the work in charge. Mr. Winchester is now a member of the Board of Electric Light Commissioners.

The station is located on State street, adjoining the New York, New Haven and Hartford Railroad tracks. The building is a substantial brick and fireproof structure, with a slate roof, on which are two cupolas. The one at the front is for the ventilation of the engine room and receiving the circuits, and that in the rear for the ventilation of the boiler room. As shown in our illustration, the station is one story high and covers an area of 40 feet front on State street, extending back 66 feet. The interior is divided into two apartments by a brick wall. One section is used as the engine and dynamo room, and the other as a boiler and fuel room. The engine room is 38 by 30 feet in size, and the boiler room 38 by 35 feet. The boiler is of the horizontal, tubular type, of 125 H. P. It is 6 feet in diameter and 16 feet long, and is provided with a Weitmeyer patent furnace, which effects great economy in fuel. There is also in the boiler room a 200-H. P. feedwater heater, and a 200-H. P. injector. There is storage

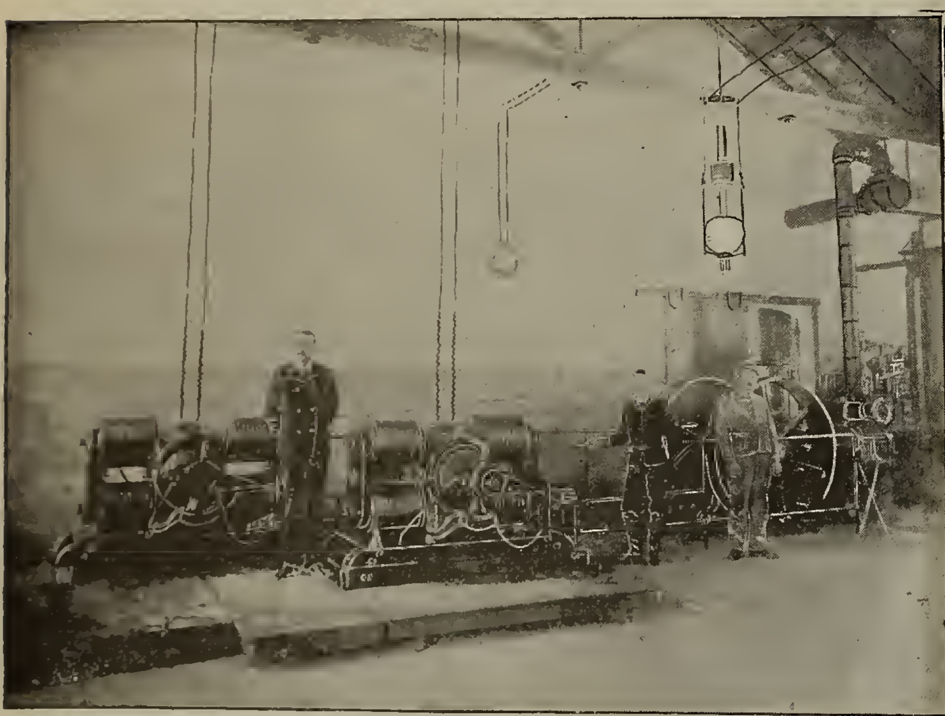
space for about 60 tons of coal. The smoke-stack is of iron, 33 inches in diameter and 60 feet high, and the draught is controlled by an automatic damper regulator.

In the engine room is a 100-H. P. Ideal automatic high-speed engine, which makes 300 revolutions per minute. It has two fly-wheels, each five feet in diameter. The wheels are belted direct to two Western Electric dynamos of 60 arc lights capacity each. Each dynamo is equipped with automatic regulators and is, besides, provided with switches, by the use of which the lamps can be burned at 1,200, 1,600 or 2,000 candle-power. These changes are effected by the cutting in and out of sections of the field coils.

A very efficient and simple lightning arrester is used in this plant. It consists of three blocks of copper, about two inches square, placed in a line with reference to each other on top of the dynamo. The blocks are separated by a space of about the thickness of an ordinary card. The middle section is connected to ground, and the two end pieces to the line. This arrester has never failed to act, the lightning every time jumping the space beween the blocks to get to ground.

All the necessary electrical testing and regulating apparatus are also conveniently located in the dynamo room.

The apparatus for the city fire alarm system is also operated from this station. The batteries and apparatus for



DYNAMO ROOM SOUTH NORWALK PLANT,

the operation of the system are located on a gallery at the front end of the room. Underneath this gallery is a store room 8x21 feet in size, provided with all the necessary tools, supplies, etc., used in the operation and maintenance of the plant.

The station is arranged with a view to future enlargement, and provision is made to double the capacity of the plant without any material alterations. All the steam, exhaust and feed-piping are double the size really necessary for the present service.

The floor of the boiler room is of very solid construction. It consists of brick laid on edge. The floor of the dynamo is of concrete, giving a very firm foundation for the machinery.

From the cupola two electrical circuits diverge. They supply about 99 arc lamps, which are distributed about the city streets and municipal buildings. Most of the lamps are suspended across intersecting streets, the rest being either on mast arms or pole tops. There are about 15 miles of wire.

This plant is controlled by three electric light commissioners elected by the people, each serving a term of three years, one new commissioner being elected at each annual election. It is their duty to have charge of and maintain the electric lighting and fire-alarm systems of the city.

The last annual report of the Board shows the following interesting figures :

Average distance between lamps, in feet	500
" lamps in service during the year	98
" candle-power per lamp	1,400
" number of nights lighted during the year	309
" cost per lamp per night (interest and depreciation excluded)	$13\frac{7}{10}$
" cost per lamp per night (interest and depreciation included)	$19\frac{2}{10}$
" cost per lamp per year (interest and depreciation included)	\$59.29$\frac{3}{10}$
" cost per lamp per year (last report)	\$64.53$\frac{1}{4}$
" pounds of coal per night	2,282.5
" " " " per light	23.29

The maintenance of the electric light system cost the city $4,648.78 during the year.

The present board consists of Leslie Smith, Colonel of the U. S. A. (retired,) J. A. Volk, manager of a large hat factory in South Norwalk and a prominent business man in that place, and Mr. A. E. Winchester, a member of the Electrical and Mechanical Engineering Co., of New York city. Mr. Winchester was for many years connected with the Edison Electric Light Co. and afterwards with the General Electric Co. as a designer of central stations. He is the consulting engineer of the South Norwalk plant.

Both Messrs. Smith and Volk, the other members of the board, stand high in the community and the combination of the three gives a very efficient board.

THE EDISON ELECTRIC ILLUMINATING COMPANY OF NEW YORK.

In his annual report Mr. R. R. Bowker, first vice-president of the Edison Electric Illuminating Co., of New York, that gentleman gives some interesting facts regarding the operation of the company during the past year. We quote as follows from the report :

The Duane street station building, which had been erected to its full height at the close of last year, has been completed in its general features, and the general offices are now permanently established on the upper floors. All the operating machinery in the down town district, with the exception of the two small units in the Produce Exchange Annex, is now concentrated there, and the historic Pearl street station has been abandoned and dismantled of its entire equipment, and the realty offered for sale. The 2,500-H. P. Van Vleck disconnective engine, which represents our largest type of unit, has been put in service during the year in the Duane street station, as well as an additional 600-H. P. engine, intended ultimately for the upper district, making the present steam equipment one 2,500-H. P. engine, two 1,250-H. P. engines, and three 600-H. P. engines, a total of 6,800-H. P. Steam is supplied by eleven of the new double Babcock and Wilcox boilers, in their permanent place on the boiler room floor. The station is thus equipped to less than one-third its final capacity, and the down-town district can be supplied for years to come without further investment in station realty. The station is now operated from its permanent electrical platform, equipped with the new Van Vleck "edgewise" apparatus, which permits remarkable centralization of control in the smallest possible space. The Duane street station has now a working capacity of about 4,400 K. W., or 33,000 amperes, and the Produce Exchange Annex a capacity of 2,000 amperes.

The 26th street station was equipped with its full complement of machinery last year, but considerable improvements have been made at the switchboard and in the electrical fittings. It has now a rated capacity of approximately 20,000 amperes. The 39th street station has been further equipped, some of the machinery of the old Pearl street station having been transferred to it. It has now ten engines of a total of 2,250-H. P., and nine boilers, about two-thirds of its final equipment, and it has a working capacity of 12,400 amperes. It has been run throughout the year as a one-watch annex, and besides supplying the large opera and theatre installations in its own neighbor-

hood, has supplemented the 26th street station through the tie-feeders, of which a third has been provided during the year by rearranging existing feeders. The 53d street station has also had some additions to its equipment, partly from the old Pearl street machinery, and has now a capacity of 3,500 amperes, exclusive of storage battery. This station is not yet in permanent shape, but the development in the up-town district has not been sufficiently rapid during 1894 to require the development of final plans for the 53d street station in 1895, although some increase will be necessary in its equipment.

The great demand for electric current is at the southern portion of each district, down-town below the Duane street station and up-town below the 26th station. The Duane street station is well located and is of adequate size to supply the down-town district, and the development of demand in the region between Canal street and 8th street will doubtless make increasing requirement upon it up to the final limits of its capacity. The 26th street station, however, reached its full equipment last year, and for the past two years it has been helped out at the time of maximum load from the 39th street station.

The section of the city in which the demand for electric current is greatest and the supply least is that from 14th to 23d streets, inclusive, and it became, therefore, a pressing question whether additional building should be undertaken at 26th street, or whether some provision should be made south of 14th street, where a station had originally been proposed in the neighborhood of 8th street. In view of the undesirability of duplicating the 26th street station, either at the east or north of the present building, and the costliness of running adequate feeders from that locality, it was decided to make an annex installation in 12th street, and for that purpose arrangements were made by which the company has come into possession of the property 115 12th street and will acquire later the adjoining properties, 117 and 119 East 12th street, whence the present feeder system may be tapped to good advantage at a minimum cost. A contract was made with the Electric Storage Battery Company, of Philadelphia, for the installation of a storage battery there in time for the winter's load, but legal questions arose (as to the result of which this company was amply protected by its contract) which delayed the installation of the battery. These legal difficulties were removed during the latter part of the year by a consolidation of the rival storage battery interests; but it had not seemed wise for this company to await the legal results, and, therefore, arrangements were made with the Storage Battery Company, protecting this company against loss in placing a temporary generating installation, under which a generating plant, including a 500-H. P. engine and two 60-K. W. generators (the latter transferred from the down-town districts,) were placed in the lower portion of No. 115 East 12th street. This plant was rapidly installed and was started in November, 1894, greatly relieving the neighborhood to the north, and enabling the 26th street station to care for its load more effectively and economically. The result has been one of increased saving to the company and of increased satisfaction to its customers. It has become evident that this is a proper centre for further supply, and plans are now under consideration which, at a minimum investment, will provide for a station on a new plan, combining the best features of the horizontal types of station, and giving room for an equipment approximately as large as that of the 26th street station. The erection of such a station, and the completion, subsequent to 1895, of the 53d street station, should provide the company for years to come with all the stations necessary to cover the territory from Battery to 79th street.

THE "STANDARD" CYCLOMETER.

The electrical features of the exhibit of the New York Standard Watch Co., of 11 John street, New York, at the bicycle exhibition last week were very attractive. This company made a large exhibit of its excellent cyclometers, and with the aid of electricity the practical operation of these devices was satisfactorily shown.

A bicycle was raised from the platform and the wheels kept revolving by means of a belt connected with a small electric motor. The wheels revolved at a speed of 30 miles an hour, and the operation of the cyclometer could be easily watched.

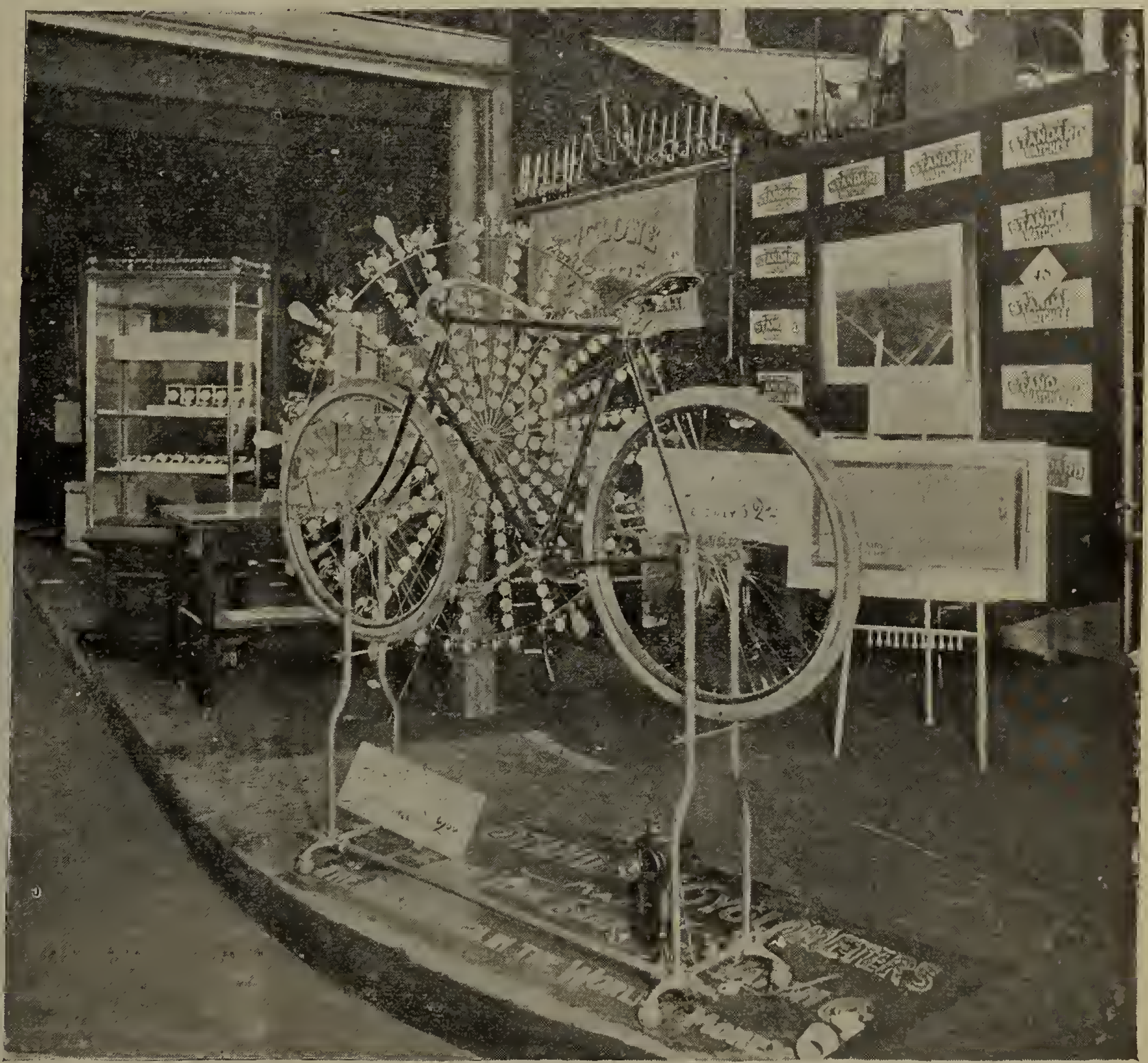


EXHIBIT OF NEW YORK STANDARD WATCH CO. AT THE CYCLE SHOW.

Within the inclosure was a large wheel, six feet in diameter, with nickel spokes. The spokes were covered with cyclometers arranged in a symmetrical manner, and gilt cyclometers were placed around the rim. Around the circumference of this wheel were placed 12 colored incandescent lamps arranged radially. The colored bulbs—red, white and blue—gave a very pretty effect as the wheel revolved. Three hundred and fifty-four cyclometers were used on this wheel alone, the value being $800.

Our illustration gives a view of this exhibit. The "Standard" cyclometer is claimed to be very accurate in its records, unequalled in durability, strong, simple, light, noiseless, dust-proof and waterproof. It is the smallest in the market and low in price. The fact that it is made by a first-class concern is a sufficient guarantee that this cyclometer is also first-class.

Magnetic Potential.—We have received, with the compliments of the author, a copy of a pamphlet containing an article entitled "On Magnetic Potential" by Frederick Bedell, Cornell University.

A MOTOR BICYCLE.

One of the most interesting features of the Cycle show at Madison Square Garden last week was the Motor Cycle.

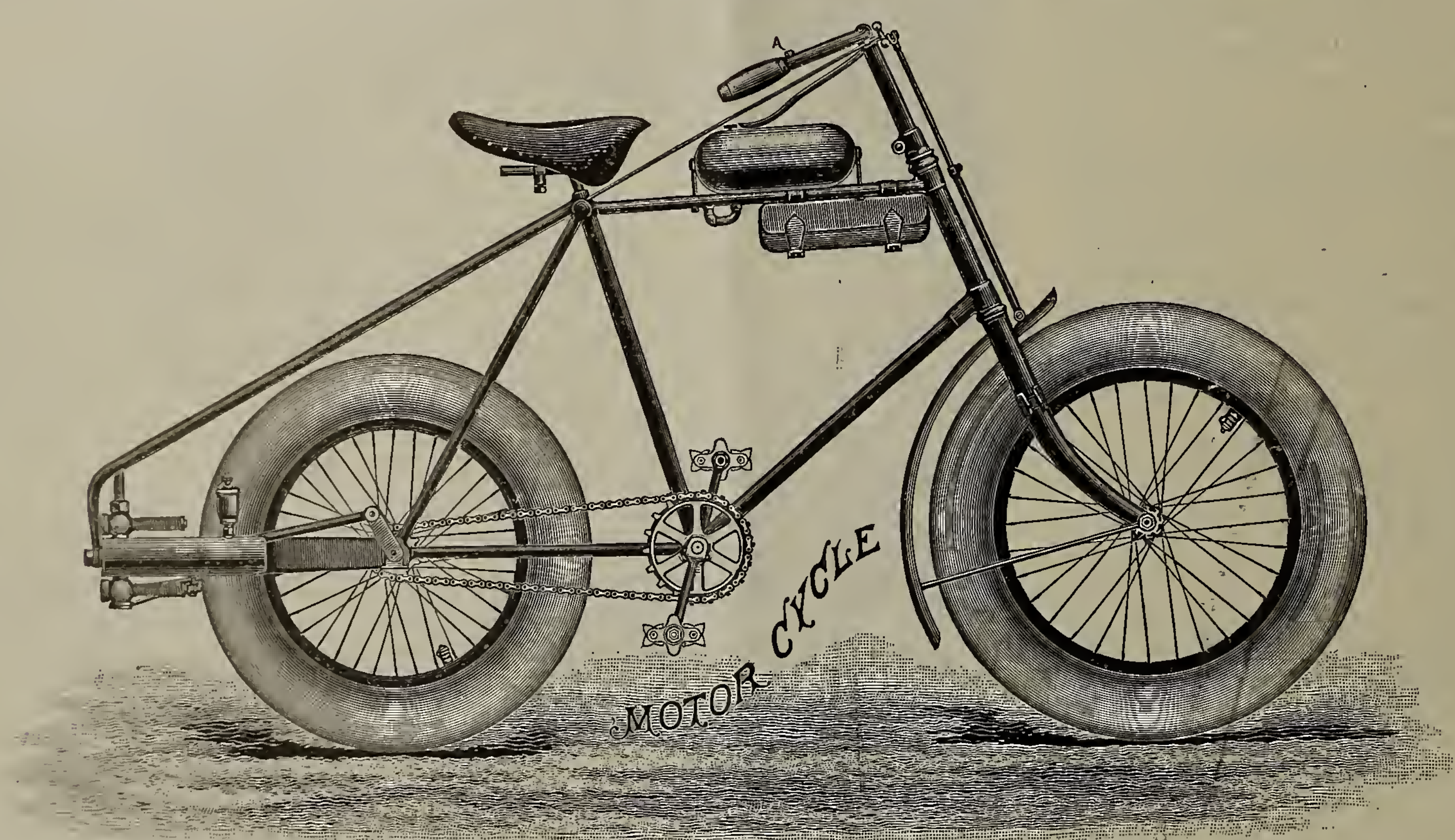
This machine is provided with a small hot-air motor at the rear, which supplies the power for the propulsion of the wheel. The gas is ignited by an electric spark generated by a small cell of battery carried on the frame.

The machine attains a high speed over ordinary roads, without any fatigue whatever to the rider.

It is first started by the pedals, and by switching on the current by means of a switch on the handle-bar the gas-power is instantly applied.

The machine may be propelled by foot-power if desired.

The power mechanism consists of two hot-air engines, one on either side of the rear wheel. Each engine represents one horse-power, and either one or both may be operated. The oil can is attached to the frame in front of the rider, the oil being conveyed through the frame to the cylinders of the engines, where it is mixed with air. The gas is then ignited by the electric spark, the sudden expansion causing the pistons to act in the usual manner.



THE MOTOR BICYCLE EXHIBITED AT THE CYCLE SHOW.

The battery is of the ordinary kind and will last for four to six months. It is carried in the tool bag.

The total weight of the machine is 60 lbs. Our illustration gives an excellent view of this novel wheel, which interested great crowds during the show all through last week.

This machine is made by the Hancock Manufacturing Co., Cortland, N. Y.

THE CLEVELAND CONVENTION.

In addition to the list of papers to be read at the Cleveland meeting of the National Electric Light Association, on February 19, 20 and 21, which list was published in a recent issue of the ELECTRICAL AGE, one will be read by Nelson W. Perry, entitled "The Storage of Energy Essential to Central Stations: How It May Be Accomplished and the Economies Resulting." Professor Langley, of Case School, and Professor Stine, of Armour Institute, Chicago, will take part in the discussion.

The topic, "How to Light Large Cities," will be discussed by Frederic Nicholls, Charles R. Huntley, Frank H. Clark, J. Frank Morrison, T. Carpenter Smith, George A. Redman, E. F. Peck, and others.

LEGAL UNITS OF ELECTRIC MEASURE.

In an article in *Science*, of January 4, 1895, Dr. T. C. Mendenhall, of the Worcester Polytechnic Institute, Worcester, Mass., refers to the recent action of Congress in legalizing units of electrical measure. He then gives a concise history of the efforts made and action taken with the object of reaching an international agreement as to these units, their value, their number and their names, and dwells especially on the work accomplished at the International Congress in Chicago in 1893.

Representative Shane, of Pennsylvania, prepared and introduced a bill into the House of Representatives, early in 1894, defining these units substantially in agreement with the definitions adopted by the Chamber of Delegates, of the International Congress, and declaring them to be the legal units of electrical measure for the whole of the United States. The bill became a law by the approval of the President on July 12, last.

The differences between the definitions adopted by the International Congress at Chicago and those found in this law are very slight, and consist entirely of verbal changes that were thought to be desirable and necessary by the Senate Committee to which this bill was referred after its passage by the House of Representatives.

This act, as it became law, is then given in full.*

It will be desirable to add some remarks, continues Dr. Mendenhall, upon the steps which have been taken in the same direction by the English Government since the adjournment of the International Congress. All who are familiar with the legislation in the United States on the subject of Weights and Measures will recognize the passage of the Act given above as the first general legislation establishing units of measure for the whole country, on the part of the American Congress.

Although the Constitution provides that Congress shall have the power to establish systems of weights and measures, it is well known that Congress has never exercised this power except in the Act of 1866, which involves the semi-establishment of such a system by making the use of the Metric System permissive throughout the United States. Aside from this, systems of weights and measures in this country have been uniformly and universally the result of State legislation until the passage of the above Act defining units of electrical measure.

In England a committee has for some time been in existence whose object was the recommendation of suitable

* See ELECTRICAL AGE, September 1, 1894, page 121.

units of electrical measure, that they might be legalized, as is the practice in Great Britain, by means of an 'Order in Council' signed by the Queen. Among the members of this committee are such well known names as Lord Kelvin, Preece, Glazebrook and Ayrton. This committee made a report on the 2d of August, 1894, and this report was approved by the Queen on the 23d of the same month, so that in this country we were a little more than a month in advance of Great Britain in the legalization of units of electrical measure. The English committee, however, did not feel prepared to go as far as we have gone in the recommendation for the adoption of the whole list of eight units approved at Chicago. Some members of this committee have explained this in personal conference by the statement that the three primary units, the ohm, the ampere and the volt, were found to be not difficult of material representation, while most of the others were very decidedly so, and, as most of the others are derived from these three, it was thought best, at the present time, to restrict authoritative adoption to the ohm, the ampere and the volt. In defining these units the English committee has also departed slightly from the definitions as adopted at Chicago the changes being mostly verbal, but, in one or two instances, of such a character as to quite alter the fundamental relation of the materialized unit to its theoretical representative. In order that this may be clearly seen, it may be well to quote the definitions of these three units, as found in the 'Order in Council' of August 23d. The following is quoted directly from said 'Order:'

"And whereas it has been made to appear to the Board of Trade that new denominations of standards are required for use in trade based upon the following units of electrical measurement, viz.:

"*First.* The Ohm, which has the value of 10^9 in terms of the centimetre and the second of time and is represented by the resistance offered to an unvarying electric current by a column of mercury at the temperature of melting ice 14.4521 grammes in a mass of a constant cross sectional area and of a length of 106.3 centimetres.

"*Second.* The Ampere, which has the value $\frac{1}{10}$ in terms of the centimetres, the gramme and the second of time, and which is represented by the unvarying electric current which, when passed through a solution of nitrate of silver in water, in accordance with the specification appended hereto and marked A, deposits silver at the rate of 0.001118 of a gramme per second.

"*Third.* The Volt, which has the value of 10^8 in terms of the centimetre, the gramme and the second of time, being the electrical pressure that if steadily applied to a conductor whose resistance is one ohm will produce a current of one ampere, and which is represented by .6974 $(\frac{1000}{1434})$ of the electrical pressure at a temperature of fifteen degrees C, between the poles of the voltaic cell known as Clark's cell, set up in accordance with the specification appended hereto and marked B."

The specifications referred to in the above as marked A are those that were adopted at the Chicago Congress, together with some additional suggestions as to the methods of procedure.

The specification marked B refers to the method of preparation of Clark's cell, including a detailed statement as to materials and as to the method of setting up the cells. These specifications are made so as to include several different kinds of cells, so that the Lord Rayleigh modification of the Clark cell, and also a modification devised and used by the Germans, may be used at will. There is certainly a decided advantage in this. Attached to the 'Order in Council' is a schedule which is declared to set forth the several denominations of electrical standards as approved by the Queen. In this schedule the standard of electrical resistance is described as being the resistance between the copper terminals of a particular coil of wire under standard conditions. The standard of current is described as being the current which when passed through the coils forming a part of a particular instrument under specific conditions gives rise to forces which are exactly balanced by the force of gravity at Westminster upon a particular mass of matter forming a part of said instrument. The standard of electromotive force, or, as it is termed in the 'Order in Council,' 'electrical pressure,' which is denominated as one volt, is described as being $\frac{1}{100}$ part of the pressure which when applied between the terminals of a particular instrument causes the rotation of a certain portion of said instrument to the extent which is measured by the coincidence of a certain wire with the image in the eyepiece of the telescope and with certain fiducial marks.

A careful examination of the above definitions, together with the schedule following, and a comparison of the same with the units as defined by Act of Congress, which are essentially those of the Chicago Chamber of Delegates, will give rise to many interesting and important reflections to which space cannot now be given. It may be suggested however, that there is room for uncertainty under the provisions of the English regulations as to what is the standard of resistance, or of current, or of electromotive force. Of course this will all turn upon what would be the action of the English authorities in case of a suspected error in the material representation of these standards as provided for in the schedule. The 'Order in Council' makes no provision for a course of procedure in such an event, and it is but natural to assume that standards of a very complicated character, and so composite in material as those thus adopted, must be continually liable to changes, and the reintroduction of errors of considerable magnitude.

The actual material representations of these three electrical units, it will be observed, are by this 'Order' removed at a considerable distance from the fundamental definitions adopted by the English committee, as well as by the Chicago Chamber of Delegates, thus, although the ohm is defined primarily by reference to the C. G. S. system of units, and secondarily by reference to the column of mercury, in actual practice it is neither the one nor the other of these, but is the resistance of a solid metallic conductor.

The ampere, while defined primarily in terms of the C. G. S system, and secondarily in reference to the silver voltameter, is in practice determined by the dynamic action of one current upon another. In the same way, the volt is not in practice referred to the C. G. S. system of units, nor is it determined by comparison with the Clark cell, but by the measurement of the rotation effect upon a part of a certain instrument when the electromotive force is applied between certain points in that instrument.

One cannot refrain from the opinion that, from an absolutely metrological standpoint, the regulations of the 'Order in Council' should be condemned rather than approved; however, personal conference with the representatives of the English Board of Trade and Standardizing Laboratory reveals the fact that the material representations of electrical units, thus provided, are to be considered as but tentative in character, adopted on account of greater convenience in actual practice, and to be continually revised and corrected by reference to the fundamental definitions, which are essentially the same as those approved by the representatives of Great Britain at the Chicago Congress, and where they do differ from those are, it will be generally admitted, I think, on the whole, more sound.

It is very important for the United States that, when the time shall come, as it must before long, for the preparation of material representations of as many of the electrical units that have been legalized as can conveniently be represented, the greatest effort shall be made to see that there be no hasty action, and that, as far as possible, already well established principles of metrology shall be strictly applied.

American Trolley Poles For Export.—A dispatch from Wilmington, Del., on January 24th reports that the Delaware Iron Works of New Castle, Del., has received an order for 500 tons of iron trolley poles for Dublin, Ireland, and Bristol, England.

Rapid Transit.—The committee of experts appointed by the Rapid Transit Commission, New York, has rendered their report. They recommend empowering the elevated railroad company to build four tracks.

ELECTRICAL STANDARDS.

(*Continued from Page 57.*)

In the use of the above standards the limits of accuracy attainable are as follows:

For the ohm, within one-hundredth part of 1 per cent.

For the ampere, within one-tenth part of 1 per cent.

For the volt, within one-tenth part of 1 per cent.

The coils and instruments referred to in this schedule are deposited at the Board of Trade Standardizing Laboratory, 8 Richmond-terrace, Whitehall, London.

Specifications referred to in the foregoing Order in Council.

SPECIFICATION A.

In the following specification the term silver voltameter means the arrangement of apparatus by means of which an electric current is passed through a solution of nitrate of silver in water. The silver voltameter measures the total electrical quantity which has passed during the time of the experiment, and by noting this time the time average of the current, or if the current has been kept constant the current itself, can be deduced.

In employing the silver voltameter to measure currents of about one ampere the following arrangements should be adopted: The cathode on which the silver is to be deposited should take the form of a platinum bowl not less than 10 centimetres in diameter, and from four to five centimetres in depth.

The anode should be a plate of pure silver some 30 square centimetres in area and two or three millimetres in thickness.

This is supported horizontally in the liquid near the top of the solution by a platinum wire passed through holes in the plate at opposite corners. To prevent the disintegrated silver which is formed on the anode from falling on to the cathode, the anode should be wrapped round with pure filter paper, secured at the back with sealing-wax.

The liquid should consist of a neutral solution of pure silver nitrate, containing about 15 parts by weight of the nitrate to 85 parts of water.

The resistance of the voltameter changes somewhat as the current passes. To prevent these changes having too great an effect on the current, some resistance besides that of the voltameter should be inserted in the circuit. The total metallic resistance of the circuit should not be less than 10 ohms.

Method of Making a Measurement.

The platinum bowl is washed with nitric acid and distilled water, dried by heat, and then left to cool in a desiccator. When thoroughly dry it is weighed carefully.

It is nearly filled with the solution, and connected to the rest of the circuit by being placed on a clean copper support to which a binding screw is attached. This copper support must be insulated.

The anode is then immersed in the solution so as to be well covered by it, and supported in that position; the connections to the rest of the circuit are made.

Contact is made at the key, noting the time of contact. The current is allowed to pass for not less than half-an-hour, and the time at which contact is broken is observed. Care must be taken that the clock used is keeping correct time during this interval.

The solution is now removed from the bowl, and the deposit is washed with distilled water and left to soak for at least six hours. It is then rinsed successively with distilled water and absolute alcohol, and dried in a hot-air bath at a temperature of about 160 deg. C. After cooling in a desiccator it is weighed again. The gain in weight gives the silver deposited.

To find the current in amperes, this weight, expressed in grammes, must be divided by the number of seconds during which the current has been passed, and by 0.001118.

The result will be the time average of the current, if during the interval the current has varied.

In determining by this method the constant of an instrument the current should be kept as nearly constant as possible, and the readings of the instrument observed at frequent intervals of time. These observations give a curve from which the reading corresponding to the mean current (time average of the current) can be found. The current, as calculated by the voltameter, corresponds to this reading.

(*To be continued.*)

DEATH OF MR. EICKEMEYER.

Mr. Rudolph Eickemeyer, the well-known electrical inventor of Yonkers, N. Y., died at Wormley's Hotel, in Washington, D. C., January 23.

Mr. Eickemeyer was on his way South for the benefit of his health and had stopped over at Washington to transact some patent business. While there he was taken ill. He had been a sufferer from asthma for many years.

Mr. Eickemeyer was a Bavarian by birth and came to the United States after the revolution in Bavaria in 1848. He was a prolific inventor, and in the electrical field he is well known mainly through his dynamo, and his electric railway system. He had a large plant in Yonkers, of which place he was one of the most prominent citizens. He was appointed by the Common Council, in 1872, one of a committee to procure a new supply of water for the city, and was afterwards elected President of the Water Commissioners, which office he held at the time of his death.

Mr. Eickemeyer leaves a widow and six children. His son Carl was with him at the time of his death.

Want an Increase of Wages.—The question of wages is the subject of a conference between a committee of the Conductors, Motormen, and Drivers' Union in Boston, and the West End Street Railway Company. The committee of the Union demands for the men an increase of pay to $2.50 a day and a reduction of labor to nine hours inside of eleven consecutive hours. This question seems to be the most difficult one to settle. It is stated, however, that in any event no strike will be ordered.

Our "Telephone Number."—The *Indianapolis News*, of Indianapolis, Ind., in its issue of January 19, makes a very complimentary editorial note regarding our telephone number of January 12. Mr. Charles R. Williams, the editor of that paper, thus shows his appreciation of enterprise in trade journalism.

Lecture.—John F. Skirrow will deliver a lecture before the Department of Electricity, Brooklyn Institute of Arts and Sciences, on February 1. The subject of Mr. Skirrow's lecture will be "The Telegraph Engineering of the New Postal-Telegraph Headquarters in New York," and he will illustrate his remarks by lantern photographs. The lecture will take place in the Edison Building, 360 Pearl street.

Notes of General Interest.

Croton-on-Hudson is to have an electric light plant shortly.

The Electric Light and Power Co., of Syracuse, N. Y., has recently reduced its rates for electric lighting from 14 cents to 12 cents per 1,000 watts.

Supt. A. O. Dayton, of the West Jersey, Camden & Atlantic Railroads, Camden, N. J., confirms the report that the Pennsylvania Railroad Co. is contemplating the use of electric motive power on the Camden and Atlantic Railroad.

UNOFFICIAL REPORTS ABOUT GENERAL ELECTRIC.

A dispatch from Boston on January 22 states that the Board of Directors of the General Electric Company passed the following resolutions on that date :

"Various printed statements (favorable and unfavorable) regarding the company and its business have heretofore appeared, most of them reading in a manner calculated to give the impression they are either issued with the sanction of this company or from information furnished by its officers or directors; and whereas, in point of fact, and almost without exception, such statements if made are unofficial, and, while often having some foundation in fact, are so inexact as to be to a great extent misleading.

"Now, therefore, be it resolved, that the Board of Directors desires to caution the public against assuming that any casual statements, whether favorable or unfavorable, emanate from sources competent to furnish information respecting this company.

"Resolved further, that this Board now state for the information of stockholders that the company is entirely free from floating debt. Since the date of the last annual report the company has purchased $1,127,000 of its debenture bonds, using for the purpose the proceeds of various accounts and assets which have been liquidated since the date of the said report."

F. A. LA ROCHE & CO.

In our last issue we gave a brief item respecting the dissolution of the La Roche Electrical Works of Philadelphia. Since then we have received fuller details from Mr. La Roche regarding the matter. The primary reasons for liquidating the company while it was still solvent was the difficulty experienced in making collections and the closeness of the money market. It had been the intention of the company to increase its capital stock to $1,000,000 and to secure subscriptions to the increased stock to the extent of $500,000, but owing to the depressed condition of the financial market it was found impossible to interest capital in a manufacturing concern, and as there were no indications of an improvement in these conditions, the company decided to liquidate as referred to.

The financial report of the company shows that the assets are ample to satisfy all concerned. Mr. La Roche considers that the steps taken were creditable, since, had the company gone on through the year without financial relief, the results might have been disastrous.

Mr. La Roche has associated with him certain gentlemen of financial means and proposes to continue the manufacture of the well-known La Roche apparatus. He will in all probability purchase the entire equipment of the La Roche Electric Works, after an appraisement has been made. The new firm is known by the title of F. A. La Roche & Co , and the business will be continued for the present at the old stand, at the corner of American and Diamond streets. Mr. J. Franklin Stevens was appointed assignee of the company.

THE STANDARD UNDERGROUND CABLE COMPANY.

The Standard Underground Cable Company, Pittsburgh, Pa., held its annual meeting on January 22, 1895, and the old Board of Directors was re-elected as follows : George Westinghouse, Jr., Mark W. Watson, J. W. Dalzell, James H. Willock, John B. Jackson, George B. Hill, John Moorhead, Jr., Robert Pitcairn, Joseph W. Marsh.

The gross business for the year 1894 was $963,464.00, which is an excess of $101,551.00 over the business for the year 1893.

Out of the net profits for the year the company paid four quarterly dividends of 1½ per cent. each, or $60,000 in all. The capital stock is $1,000,000 fully paid up, with a surplus of $531,000.00. The company has practically no debts, except for current purchases for the months of December and January.

The prospects for the year 1895 are very good; the unfilled orders carried over from last year amounted to $58,000.00, in addition to which the third annual contract with the Philadelphia Traction Company for lead-covered underground feeders has just been secured, besides an annual contract with an Electric Light and Power Co. for electric light cables, which two contracts give promise of at least $250,000.00 worth of business during the year. The Philadelphia Traction Company has bought from the Standard Underground Cable Company about $700,000.00 worth of feeder cables (practically underground, but also some overhead) in the last three years, and, owing to special patented devices furnished by the Cable Company, the Traction Company has an extremely satisfactory and flexible system.

During the past year the Cable Company has furnished many underground feeders for street railways, and had at one time four separate large contracts under construction simultaneously, two in Philadelphia, one in Boston and one in Rochester, N. Y. The company has in its employ a large force of experts, and well-organized gangs of trained men, experienced in and familiar with all classes of underground and overhead cable work, whether for telephone, telegraph, electric light or street railway service.

In order to relieve the crowded condition of the factories the company erected during the past year a two-story and basement building adjacent to its former factories, at the corner of 16th street and Allegheny Valley Railway, Pittsburgh, and this building will be ready for occupancy in a few weeks. The company also expects to erect early this spring a large four-story and basement building on the site of one of its present factory buildings; and, when this is completed, it will have an extensive and conveniently arranged plant, with sufficient capacity to keep up with any demands that may be made upon it for a good many years.

New York Notes.

Office of the Electrical Age,
World Building, New York,
January 28, 1895.

In regard to the Rapid Transit problem for this city, Mayor Strong is quoted as saying : "I am going to see that the rapid transit which has been promised for such a long time is a reality. I am opposed to having the road built not as it should be because the $50,000,000 would have to be exceeded. I believe that as much money should be spent as is absolutely necessary to build the road as it should be constructed. I hear that the Commissioners are going to ask the Legislature to amend the statutes bearing on the rapid transit road, and I favor the proposition to amend them so as to permit enough money to be spent to make the road a success."

Geo. L. Colgate Company are now settled in their new offices in the Electrical Exchange Building, and the change is a great improvement in many ways. They report business as very satisfactory, especially in incandescent lamps. Among the specialties that this company manufactures is the "Swinging Ball" Lightning Arrester. They have received some very satisfactory orders lately from their several agencies in anticipation of the spring business, all of which indicates that the "Swinging Ball" Lightning Arrester is even more popular than ever. W. T. H.

New Corporations.

The Spiral Wire Company, Portland, Me., to carry on the business of electric lighting, etc. Capital, $1,000,000.

Tipton Telephone Company, of Tipton, Ind. Directors

—E. H. Shirk, W. W. Mannis, G. M. Shartle, N. S. Marks and Jacob Horn. Capital stock, $10,000.

The Pelham Gas Light Company, Pelham, N. Y. Directors—Chas. P. Rogers, Jas. C. Meyers and J. C. Thompson.

The Cartersville Light and Power Company, Cartersville, Ga , by P. W. French, Weymouth, Mass.; F. P. Symonds, Salem, Mass.; W. E. Merrill, Haverhill, Mass.; F. M. Smith, Lyon, Mass., and J. H. Turnbull, Boston. Capital stock, $100,000.

The Great Northern Electrical Manufacturing Company, St. Paul, Minn., by Henry F. Hoyt and John F. Hoyt, of St. Paul, and R. L. Hunter, of Minneapolis. Capital stock, $100,000.

The Interstate Telephone Co., Kansas City, Mo., by C. B. Riley, president; Geo. McLean, secretary and Geo. W. Twiss, general manager. Capital stock, $100,000.

The Missouri Telephone Mfg. Co., St. Louis, Mo., by Isidor J. Kusel, Russell Parker and Geo. J. Chapman. Capital stock, $2,000.

The Economy Street Railway Company, Economy, Pa., by Hartford, Brown and others. Capital stock, $30,000.

The Goffstown Electric Light and Power Company, Goffstown, N. H.

The Associated Water, Gas and Electric Light Committee, Nevada, Mo , by F. J Tygard, of Butler, as president, and C. F. Strohm, Nevada, secretary and treasurer.

The National Trolley Company, Hackensack, N. J. Capital stock, $5,000.

The Danville Telephone Company, Danville, Ill., by Elliott E. Boudinot, Wm. M. Tobey and John White. Capital stock, $25,oco.

Possible Contracts.

Col. T. A. Edwards, Corry, Pa , is interested in a project to establish water-works and an electric light plant in that place.

The Southern New England Telephone Co. and the Hartford Electric Company have taken steps looking to the placing of their wires underground.

An electric light plant is to be established in North Tonawanda, N. Y.

A large pulp mill is to be established in Orono, Me. E. C. Denforth, of Bangor, Me., can give further information.

The Bristol Mfg. Company, Bristol, Vt., will erect a large building which will be lighed by electricity. There is a possible sale for an electric elevator.

A silk spinning mill will probably be built in Carbondale, Pa.

The Avondale Ice Cold Storage Company, Avondale, Pa , will, it is expected, soon commence the erection of its plant. W. F. Dowdall and Dr. Gifford are interested.

It now looks probable that the Norway and South Paris Electric Railroad, Oxford, Me., will be built. The *Oxford Democrat* can give further information on the subject.

A bill has been introduced in the United States Senate incorporating the Washington and Maryland Electric Railway Co. J. Kesley Schoepf is interested in the enterprise.

Mr. Vancleft, of Newburgh, N. Y., is interested in a proposed trolley line between Monticello and Neversink. It is stated that water-power will be utilized for the generation of electricity.

The Watertown Electric Railroad, Watertown, N. Y., has decided to extend its lines to Dexter.

The Lancaster Electrical Corporation, of Lancaster, Pa., has been awarded the contract to build the Reading and Womelsdorf Electric Railroad. The road will be fifteen miles long.

The entire equipment of the rolling stock of the Lima Electric Street Railway, Lima, O., was recently destroyed by fire.

A franchise has been granted to the Madison, Venice & East St. Louis Electric Railway. Ferdinand Meyer, Venice, Ill., is president. The company's new plant will probably be located at Madison. In the meantime the Venice Electric Light Co. will supply the railway company with power.

J. B. Mattingly, Charlotte Hall, Md., has purchased some timber land and will erect a large saw-mill thereon.

The Central Telephone and Telegraph Company will erect a building for its own use in Syracuse, N. Y. The wires, it is stated, will also go underground. C. A. Nicholson, of Utica, N. Y., is manager of the company.

The Westmoreland and Allegheny Traction Company, Greensburg, Pa., has applied for a charter to extend its lines from Greenburg to Wilmerding.

Groton, Vt., is talking electric light.

The City Auditor, of Sioux Falls, S. D., has asked for bids for lighting the city by gas or electricity. The City Council in February will take action in the matter.

J. W. Raeder has been granted a franchise by council of Cedarburg, Wis., for an electric light plant in that city.

The Hard Wood Floor Mfg. Co , headed by C. J. L. Meyers, Hermansville, Mich., has been organized and will erect a large plant at Saginaw, Mich.

The Erie Savings and Loan Association, Buffalo, N. Y., will erect a large building in that city.

The Lehigh Valley Traction Co., Allentown, Pa., is making surveys for the purpose of extending its line to several towns in that vicinity.

W. M. Habliston, Petersburg, Va., can give information regarding a proposed telephone exchange in that city.

The Lampasas Electric Light, Water & Power Co., Lampasas, Tex., is in the market for electric machinery, lamps, storage batteries, etc.

John E. Leggett, 2921 Locust street, St. Louis, Mo., will erect a large building to be lighted by electricity and furnished with other electrical equipment. Roche & Son, 717 Chestnut street, are the architects.

The Western Telephone Construction Company, of Chicago, has secured the contract to build a new exchange in Newark, O. It will have a capacity of over 200 subscribers.

It is reported that the Ligonier Valley Railroad Company, Greensburgh, Pa., will substitute electricity for steam on its road.

Plans are being prepared by Adolph Segal, Camden, N. J., for a sugar refinery to be built in that place.

Efforts are being made to tunnel the Palisades at Weehawken, N. J., in order to effect direct communication with electric cars between North Hudson and the Weehawken ferry.

Superintendent McKeever of the Fonda, Johnstown & Gloversville Railroad, Johnstown, N. Y., has, with others, purchased three horse railroads in the villages of Herkimer, Mohawk and Frankfort, N. Y. Electricity will be introduced on the lines.

The Elizabeth Mutual Telephone Co., Elizabeth, N. J., has been granted a franchise to establish an exchange in

that place and erect poles, etc., for the operation of the same. The company will furnish the city with police call boxes.

It is proposed to establish an electric light plant in Carrollton, Ill. Conrad E. Hensen, of Virden, Ill., is interested.

A movement is on foot in Milwaukee, Wis., to establish a municipal electric light plant, a resolution having been adopted by the City Council with that object in view.

A canning factory in Canandaigua, N. Y., is proposed. Chas. C. Sackett, Spencer Sutherland and W. R. Marks have the matter in charge.

G. A. Gano, Leominster, Mass., proposes to build a new shirt factory in that place.

It is reported that the Suburban Traction Co., Orange, N. J., will equip its Bloomfield lines with electricity.

S. M. Patterson, of the Pennsylvania Traction Co., Westchester, Pa., will take out a charter for an electric road between Westchester and Unionville.

H. T. Prince, Leominster, Mass., is interested with other capitalists in the proposed road from Greenfield to Turner's Falls, that State.

Chas. McCordy, Fulton, N. Y., is at the head of a company organized to manufacture the McCordy automatic fire-alarm system.

The Rockaway Valley Electric Railroad Co., New Germantown, N. J., proposes to extend its lines to Somerville.

A bill has been introduced in the New Hampshire legislature for the incorporation of the Merrimac Valley & St. Lawrence Electric Railroad. Among the incorporators are Thos. Sanders, Chas. Corliss and E. B. Fuller, of Merrimac, N. H.

The Portland Electric Railroad Co., Portland, O., proposes to extend its lines. Henry W. Davis and Zed Currey of Youngstown are interested.

It is reported that the Second Avenue Surface Railroad Company, of New York city, may be changed to a cable road.

M. S. Levy, 40 South Paca street, Baltimore, Md., can give information regarding the proposed new Hebrew temple in that city.

The La Follette Land and Improvement Co., 54 Wall street, New York, intends to erect a large hotel in La Follette, Tenn.

The Florida Land and Mortgage Bank, Jacksonville, Fla., can give further information regarding a proposed hotel, to cost $500,000.

A hotel to cost $250,000 is to be established in St. Joseph, Mo. Chas. Newland has received the contract.

The City and Suburban Railway Co., of Baltimore, Md., is considering the question of building a trolley line in the north-eastern section of the city.

J. A. Townsend, of Corsicana, Texas, is interested in a proposition to build an electric railway in that place.

The Raleigh Springs Electric Railway, Memphis, Tenn., proposes to extend its lines to Raleigh Inn.

The Port Tampa Street Railway Co., Port Tampa, Fla., recently organized, intends to build a line from Tampa to Port Tampa. Edward R. Gunby and A. H. Hayden are interested.

Telephone Notes.

The Northwestern Telephone Company, of Milwaukee, Wis., has petitioned for a franchise for a telephone exchange at Appleton.

N. F. Tizgard, of Rich Hill, Mo., has been granted a franchise to establish a telephone system in Nevada, Mo.

The Southern New England Telephone Company proposes to place its wires underground in Hartford, Conn.

The Central Telephone and Telegraph Company will erect a building in Syracuse, N. Y., for its own use.

A movement is on foot in Henderson, N. C., to establish a telephone exchange in that place.

W. D. Arthur, Union, S. C., proposes to establish a telephone exchange in that place.

A telephone system is to be established in Knoxville, Tenn., by J. B. Cox.

TELEPHONE PATENTS ISSUED JANUARY 22, 1895.

Telephone Transmitter.—William A. Mason, Sumter, S. C. (No. 532,979).

Telephone Switching Apparatus and Circuit.—Joseph J. O'Connell, Chicago. (No. 533,015.)

Financial.

The Flushing Gas Light Co., Flushing, N. Y., has increased its capital stock from $40,000 to $60,000.

The Cuyahoga Suburban Railway Company, Cleveland, Ohio, has increased its capital stock from $10,000 to $50,000.

The International Bell Telephone Company, of New York, has reduced its capital stock of $1,700,000 to $1,000,000.

It is reported that Congressman Tom L. Johnson and his brother Albert propose to retire from the directory of the Cleveland Electric Street Railroad Company, and that that company and the Cleveland City Cable Company will probably consolidate. This, it is said, would involve a deal of $20,000,000.

Trade Notes.

The Nicholson File Company, of Providence, R. I., has just issued an elegantly illustrated catalogue of its files, rasps and tools. The catalogue is a work of art. This company does an immense business in this line.

The Storey Motor and Tool Company, manufacturers of the Storey motor and dynamo, whose headquarters have heretofore been located in New York City, announces that hereafter its main office will be at the factory in Philadelphia, corner of York street and Sedgeley avenue. A New York office will, however, be maintained at 120 Liberty street, with Mr. N. M. Garland in charge.

The Boudreaux Dynamo Brush Company, 226 La Salle street, Chicago, has established a plant in that city for the manufacture of its patented new Foliated dynamo brush. The company keeps all the standard sizes of brushes in stock, and is prepared to make special sizes on short notice.

The Electric Heat Alarm Company, 145 High street, Boston, Mass., has just issued descriptive catalogue No. 4 of its automatic fire alarms, automatic journal bearing alarms, hotel call and fire alarm system, automatic alarms for grain elevators, coal bunkers, warehouses, etc.

Mr. C. J. Bogue, of 206 Centre street, New York, the well-known manufacturing electrician, makes a specialty of supplies for American, Fort Wayne, Schuyler and other arc lamps. He also makes a full line of dynamo supplies. He refills all kinds of commutators with the very best Billings & Spencer dropped forged segments. Mr. Bogue

has in stock a large projector, or search light, of his own make. A large number of these search lights are now in use in different sections of the country, and on the Mississippi river steamers. Mr. Bogue has large facilities for the manufacture of all kinds of electrical supplies and for the repairing of armatures, commutators, etc., for all classes of dynamos and motors. At the present time he has no less than 18 commutators to be refilled, also a number of orders for arc lamp supplies. Mr. Bogue is an old electrician and has had many years' experience.

WOVEN WIRE BRUSHES.

The Belknap Motor Co., of Portland, Maine, are the patentees and manufacturers of the best woven wire commutator brush on the market.

Electrical and Street Railway Patents.

Issued January 22, 1894.

532,760. Incandescent Lamp. Mark H. Branin, Lynn, assignor to the General Electric Company, Boston, Mass. Filed Apr. 10, 1893.

532,776. Apparatus for Bending Armature-Bars for Dynamo-Electric Machines. Henry Geisenhöner, Schenectady, N. Y., assignor to the Thomson-Houston Electric Company, Boston, Mass. Filed Oct. 23, 1894.

532,782. Magnetic Brush-Holder. John C. Henry, Westfield, N. J. Filed Dec. 11, 1894.

532,789. Electric-Fan Motor. Joseph L. Ketcher, New York, N. Y., assignor of one-third to William L. Beadnell, same place. Filed Apr. 26, 1894.

532,790. Electrical-Display Apparatus. Joseph L. Ketcher, New York, N. Y., assignor of one-third to William L. Beadnell, same place. Filed Apr. 26, 1894.

532,796. Electrical Conductor. Edward D. Lewis, Savona, N. Y., assignor of two-thirds to Fred S. Lewis, Lewis H. Hill, Adelbert D. Dusinberre, Horatio S. Johnson, Charles A. Van Housen and Charles W. Gillmer, same place. Filed June 16, 1894.

532,798. Electrically-Operated Clutch. Thomas H. Macdonald, Bridgeport, Conn. Filed Apr. 28, 1894.

532,812. Trolley-Wheel. Benjamin O. Paine, Millbury, Mass. Filed June 11, 1894.

532,814. Electric Safety Device. Charles T. Penton, Christopher C. Gartland and Patrick J. Casserly, Buffalo, N. Y. Filed Feb. 2, 1894.

532,821. Machine for Winding Armature-Coils. John Riddell, Schenectady, N. Y., assignor to the Thomson-Houston Electric Company, Boston, Mass. Filed Oct. 19, 1894.

532,826. Galvanic Battery. Charles B. Schoenmehl, Waterbury, Conn., assignor of one-half to Clark M. Platt, same place. Filed Nov. 14, 1893.

532,838. Electric Welding Apparatus. Elihu Thomson, Lynn, Mass., assignor to the Thomson Electric Welding Company, of Maine. Filed Aug. 13, 1889.

532,839. Electric Meter. Elihu Thomson, Swampscott, assignor to the General Electric Company, Boston, Mass. Filed Aug. 10, 1894.

532,860. Electric-Alarm Mail-Box. Edward C. T. Belding, Chicago, Ill. Filed Feb. 17, 1894.

532,861. Regulator for Dynamo-Electric Machines. Louis Bell, Boston, Mass., assignor to the General Electric Company, same place. Filed Dec. 18, 1893.

532,868. Electrical Annunciator. John S. Bull, New York, N. Y. Filed Apr. 23, 1894.

532,905. Trolley-Breaker. Wm. B. Potter, Schenectady, N. Y., assignor to the General Electric Company, Boston, Mass. Filed Aug. 4, 1894.

532,909. Electric Stove. Charles E. Roehl, St. Joseph, Mo. Filed Jan. 4, 1894.

532,951. Car-Fender. William L. Fees, Avenmore, Pa., assignor to himself and Charles Andrew Hill, same place. Filed Sept. 1, 1894.

532,969. Fender for Street-Cars. John J. Kennelly, New York, N. Y., assignor of one-half to John B. Benton, same place. Filed Apr. 25, 1894.

532,979. Telephone-Transmitter. William A. Mason, Sumter, S. C. Filed Oct. 26, 1894.

532,992. Car-Fender. Adelbert L. Reynolds and Davis A. Center, New York, N. Y. Filed Mar. 3, 1894.

533,015. Telephone Switching Apparatus and Circuit. Joseph J. O'Connell, Chicago, Ill., assignor to the American Bell Telephone Company, Boston, Mass. Filed May 1, 1894.

ELECTRICAL AGE

Vol. XV., No. 6. NEW YORK, FEBRUARY 9, 1895. Whole No. 404

Established 1883.

Entered at New York P. O. as second-class matter, January 18, 1891.

THE ELECTRICAL AGE PUBLISHING CO., Publisher

TERMS OF SUBSCRIPTION:

One Copy, one year,	$3.00
One Copy, six months,	1.50
Great Britain and other Countries,	4.00

Cable Address (all Cables,) "Electage," New York.

W. T. HUNT, President F. N. BASSETT, Vice-President.
T. R. TALTAVALL, Secretary and Editor.
NEWTON HARRISON, E. E., Scientific Editor.

ADDRESS ALL COMMUNICATIONS TO
THE ELECTRICAL AGE PUBLISHING COMPANY,
First Floor, World Building.
NEW YORK.

NEW YORK, FEBRUARY 9, 1895.

CONTENTS.

UNDERGROUND CONDUIT RAILWAY SYSTEMS.

One of the results of the Brooklyn strike will be an awakening in the interests of underground conduit systems of electric railways. The cutting of the overhead trolley wires was one of the most serious difficulties the companies had to contend with in their efforts to resume operations. It was a comparatively easy matter to get at the wires and sever them, and thus cripple the service, and the strikers made the most of it. Had the roads been operated on the underground conduit system they would not have been subject to this annoyance, since the conductors would not be so easily accessible. What should be the strongest and most reliable element of the overhead trolley system is really the weakest and the most vulnerable, and there is no practical way of protecting the wires against intentional violence except by having a policeman or soldier or two on each block. The advocates of the underground idea will do well to take a lesson from the Brooklyn experience. It furnishes a strong argument in favor of placing all feed and service wires underground, where they will be out of the way and beyond reach and danger.

THE CAUSE OF SOME TROLLEY ACCIDENTS.

Several trolley accidents occurred in Jersey City during the severe cold spell the early part of this week, which were attributed to the inability of the motormen to control their cars on account of the extreme cold. They were so benumbed that they did not have the strength to apply the brakes with the usual power. The motormen and drivers of street cars have a hard time at the best. In the winter they are nearly frozen, and in the summer they are reminded of the warm climate where they will spend eternity if they are not good. The vestibule car affords some protection, but from the companies' standpoint new car drivers are cheaper than vestibules.

MOB RULE IN BROOKLYN.

A remarkable demonstration took place in Brooklyn on Febuary 4. According to a prearranged programme, at 2 o'clock in the afternoon of that day several thousand trolley strikers and sympathizers gathered about the City Hall and actually compelled the Board of Aldermen to pass resolutions revoking the licenses of the Brooklyn City Railroad Company and the Atlantic Avenue Railroad Company. It has been shown that the Board of Aldermen have not the power to deprive the railroad companies of their rights to operate their lines, but in the face of all that, the so-called Board yielded to the clamor of the misguided and unfortunate strikers, and promptly passed the resolutions drafted by the labor committee. If this action on the part of the Aldermen is legal, then anarchy is rampant in Brooklyn, and the power of the law framed for the welfare and protection of the community is broken. As we have many times before stated, we think the employés were underpaid, considering the character of their work, but when they adopt the most radical anarchistic measures with a view to gaining their point they forfeit all sympathy from law-abiding citizens. No one can find fault with their seeking redress by lawful means, but let them proceed according to law, and not violate it. The strikers have shown a wonderful lack of the spirit of fair play, and strange to say they have many open sympathizers among the very persons selected to protect the interests of the public. Such a condition of things is little short of anarchy. The resolutions passed by the obliging Board of Aldermen contain some of the most absurd assertions imaginable, but, after all, rational action could hardly be expected under the circumstances There exists an intense hatred toward the railroad companies on the part of the men, and under their excitement they naturally give all sorts of fantastic expressions to their emotions. The labor leaders are big men just now, and the poor strikers are the sufferers. If Brooklyn had some backbone in its government the disturbed condition of affairs would have been long since settled.

MAGNETIC MECHANISM.

BY WILBUR M STINE, D. S .

First Paper.

When years ago the foremost physicists were compelled to formulate a conception of a medium for the transference of light and heat energy, they gave to the world a conception of an all-pervading jelly-like something they named the luminiferous ether. The properties which they were compelled to ascribe to the ether seemed in some cases paradoxical. Metaphysicians and philosophers joined the intellectual world at large in taking the whole matter as a capital joke. But this fancied wisdom has yielded to the stern necessities of recent years.

One of the greatest marvels in the past decade is the serious and general attention which has been called to the study of the constitution of ether and the motions occurring in it. The widespread desire for *cold* light and heat are in part responsible for this. But the very general attention paid to electricity and magnetism has been the preponderating cause.

It has long been recognized that magnetic phenomena

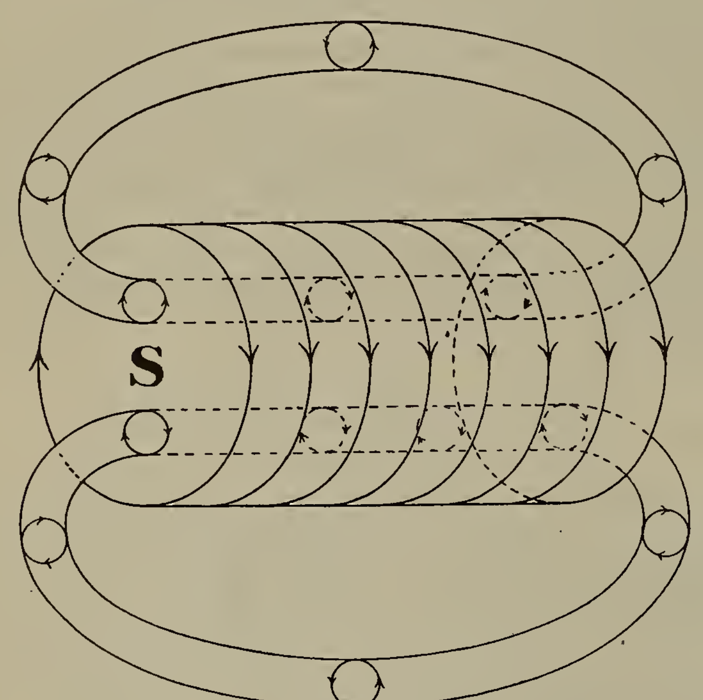


FIG. 1.

were actions taking place wholly in the ether. Yet to all but a favored few, who have had both opportunity and time for extended scientific thought, magnetism has contained much that has been empirical, and, in some cases, paradoxical. The theories of electricity and magnetism are becoming deservedly popular; the more so since their value as an aid to electrical investigation and design is generally recognized. Though there is yet much that is vague and hypothetical in these theories, still an agreement has been reached on many points by authoritative scientific thinkers.

Electricity and magnetism are now regarded as actions *in* or *of* the ether. Electricity is due to ether stresses, while magnetism involves ether rotations. It must be borne in mind that much that is here treated of is hypothetical, but the attempt is made to reduce these hypothetical ideas to actual mechanical conditions. The results of such methods joined to those of mathematical analysis must eventually determine the truth or falsity of the present current views.

We are indebted to Faraday for the idea of lines of force existing around a magnet or wire carrying a current. We have become so accustomed to pictorial fields of force indicated by lines or iron filings that a line of force is regarded as an elastic cord passing from pole to pole of a magnet. This idea enables us to deal with electromagnetic problems of strength of field, etc., just as the "two-fluid" theory of electricity is employed to enable us to solve problems of capacity, etc. If in both cases these ideas are regarded as merely symbolical they do no harm. Yet at the same time, if the true conception of these subjects can be mastered, it yields a mental pleasure aside from their utilitarian value.

A magnetic line of force is regarded as a tube or vortex whirl in the ether. The whirl is commonly pictured by saying it resembles a smoke ring. But its motion more

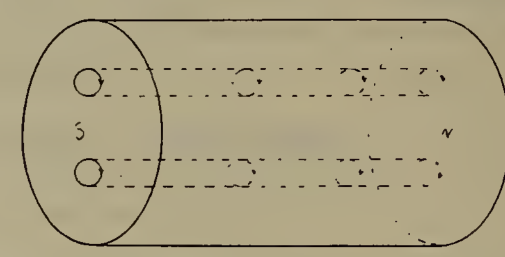


FIG. 2.

nearly resembles that of a screw; it combines a motion of rotation with a forward motion in the line of its axis.

In the mechanism of electromagnetism there is one rule that is invariable and universal. If one holds his watch in his hand and regards himself as the *source* through which the main action takes place in a straight line through the watch, the secondary effect is always circular and clockwise. The convention with reference to any line of force is that it passes in air from the north pole to the south pole of a magnet. The other requisite convention for dealing with such subjects is that the ether stress of electricity passes *from* the positive end *towards* the negative.

Let us now examine the ordinary bar magnet as usually portrayed. The lines of force are stated to pass in air from the north to the south pole of the magnet. These lines of force have a two-fold meaning: they indicate the direction of the magnetic force at any point in their path, or they may be considered as curves in which lie the resultants of the action of the two magnetic poles; they have a quantitative value as well. As line integrals of magnetic force they indicate the strength in dynes of the field for each cross-section of one square centimeter taken at right angles to them. In this manner we may deal with lines of force in the physical sense of direction, and in the mathematical relations of the magnetic fields. But it is rather to the physical analysis of magnetic fields that attention is called. A line of force is said to have a positive direction, i. e., to pass in air from the north to the south pole. Coupled with this statement is another, that an ideal magnet of one pole only will move along a line of force in a positive direction. This property of direction in a magnetic field is by no means explained by the assumption that a field of force is composed of lines, for a line in a physical sense implies no direction of motion. According to modern views these lines of force are merely representative, and should be recognized in the same sense as

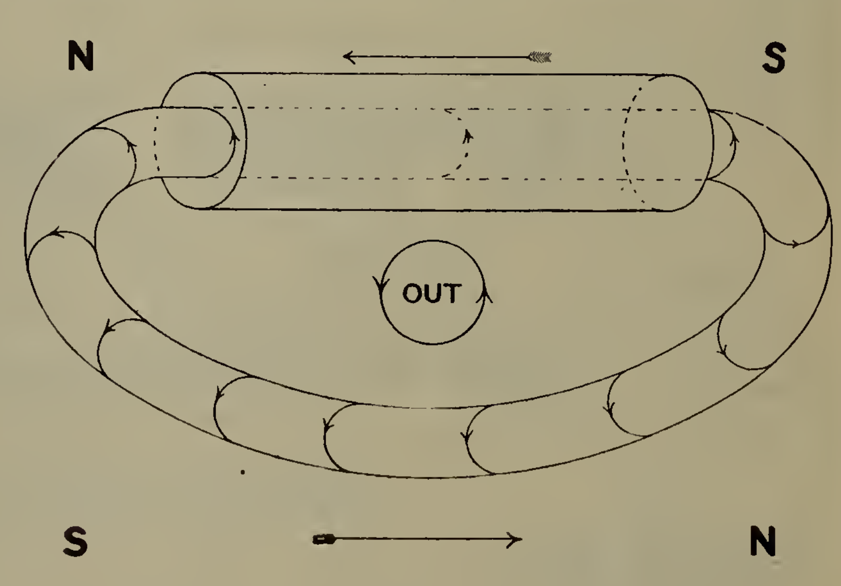


FIG. 3.

the pictured bonds or lines joining together the constituent atoms of a chemical molecule. The field in reality is not composed of lines, but of whirls, or tubes along which the ether is considered to be stressed. If the south face of a bar magnet is looked at, the direction of the tubes of

force is *from* the observer, and their rotation is clockwise. If the north aspect be regarded the other ends of the tubes are seen, and the rotation of the tubes then, with reference to the observer, is counter-clockwise.

Fig. 1 is an attempt to exhibit what physicists regard as the action really taking place in the ether *in* and *about* a bar magnet. The lines of vortical ether stress pass through the magnet from the south to the north pole and return in air with the motion of a right-handed screw. The tubes of force differ in one respect from the ordinary smoke ring which they so closely resemble in their actions. A smoke ring in common with a line does not possess

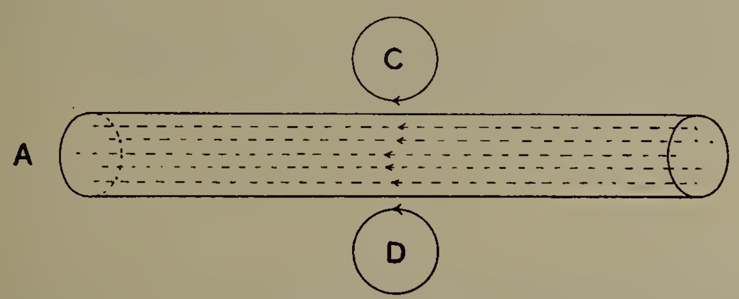


FIG. 4.

direction along its action, but merely rotation at right angles to it. The tendency of a single-pole magnet to follow a tube around its path indicates the axial direction of the tube which in consequence is thought to have a forward motion united with its motion of rotation. Fig. 2 is an attempt to picture such an ideal single pole magnet. The tubes of force are conceived to exist only in the magnet itself, and viewed from the south end are clockwise in direction. Such a magnet would move in air from the north to the south pole of an actual magnet, or in general would move along the direction, ordinarily considered, of a line of force. So far as the direction of rotation of its tubes of force is concerned this ideal magnet must possess true north and south polarity, and is, strictly speaking, not a unipolar magnet. According to this view, then, a single-pole magnet is a false conception. This ideal magnet differs from the actual magnet in so far as it does not have its tubes of force returning in air and so describing closed paths. If the actual magnet (Fig. 1) be examined it will be seen that its tendency within the magnet to move along a tube of force is exactly opposed by the tendency of its field in air to move in the opposed direction, due to the fact that its tubes of force in their return bend back upon their direction in the magnet with a consequent reversal of axial direction. The return bends being absent in Fig. 2, leave the ideal magnet free to move along the tubes of force in any field in which it may be placed by threading their whirls, as a screw does the threads of a nut. We have here an explanation of Oersted's failure as well as success in demonstrating the relations between electricity and magnetism. He at first attempted to affect a magnetic needle by bringing static charges near it. The field of force set up by a static charge is made up of tubes of ether stress having one direction of action only along their axes, and are devoid of rotation.

A magnetic whirl can thus in no case set itself along such a tube of stress. He, however, succeeded when he held a wire conveying a current over his needle. He set up, by means of a current, a field of rotating tubes of force along which the needle (fig. 3) set itself. Fig. 3 is designed to show the movement of a compass needle in a magnetic field, established by a current flowing along a conductor. On the assumption that a field of force surrounding a current is made up of concentric lines, we have no explanation of the setting of a needle in it according to relations of polarity to direction of flow. A needle or magnet would doubtless tend to set itself at right angles to the direction of flow of the current, but it would not change the direction in which its north pole points should the current be reversed, and in point of fact would not alter its position whether the current were continuous in direction or rapidly alternating. But in the actual behavior of a needle in the magnetic field of a current we are confronted with the relations of its polarity to the direction of flow of a current, and as before are compelled to conclude that a magnetic field has a direction of motion along the axes of its tubes of force. If fig. 3 be examined, it will be seen that a needle tends to set itself at a right angle to the conductor and not to move as a whole in a circular path around it. The reason is obvious. The needle, being a real magnet with return bends in its tubes of force, is held in dynamic equilibrium by opposed and equal forces. The tubes of force in the needle itself tend to rotate the needle in a circular path around the conductor, say in a clockwise sense. The returning tubes in air, on the other hand, tend to rotate it around the conductor with an equal force but in an opposed direction, counter-clockwise. As a result the needle has no forward motion, only that of a couple of forces acting on a bar, which set it so that its tubes thread the magnetic whirls set up by the conductor.

Oersted showed that a current could establish a field of force identical with that surrounding a permanent magnet. To endeavor to explain this fact necessitates some explanation of what constitutes an electrical current. If a static charge is moved with sufficient rapidity, it establishes the same sort of magnetic field as that produced by a current. It would then seem that a current was somewhat like a statical charge in motion. According to the modern views of electricity a statical charge is accompanied by a field of tubes of force. These, unlike magnetic tubes, do not rotate and hence do not return on themselves, but radiate out in space from the charge with a tendency whose direction is that of radii from a point. But in reality they are always more or less diverted from the ideal direction and represent curved rather than straight lines. They always begin on one surface and end on another. These tubes are supposed to represent a longitudinal stress in the ether, whose only direction of action is along their axes. In cases of attraction this stress may be pictured as resembling that of an extended rubber string or spiral spring. If conditions permit this stress to equalize itself, the positive or extended ends of these tubes will sweep forward through the surrounding ether. It is to the motion of the ends of these tubes of force that we must look for the establishment of an electromagnetic field. It is here, too, that we seem able to define a conductor and distinguish it from a non-conductor. Tubes of ether stress can never

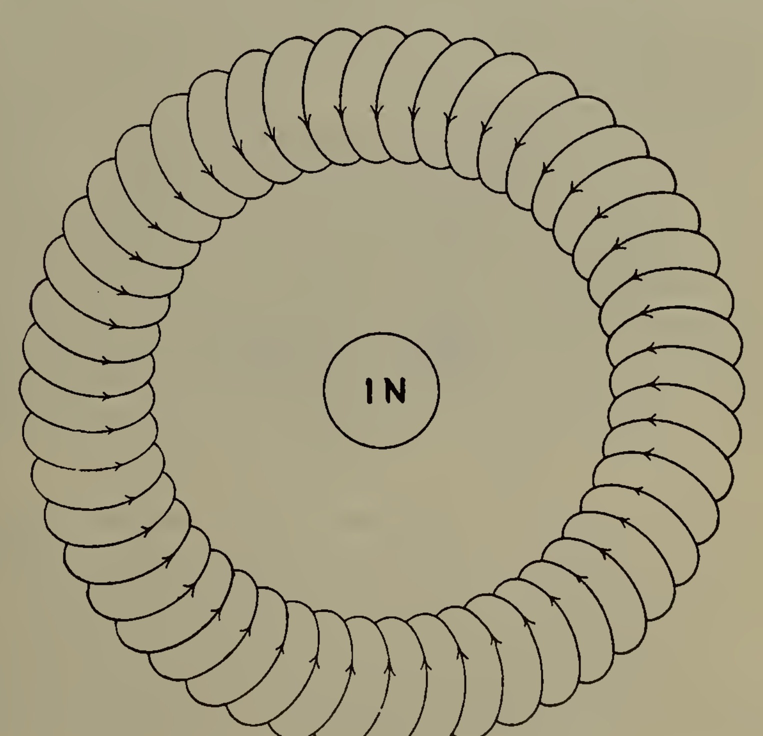


FIG 5.

equalize their stress through the intervening ether. In this sense it can not take up the energy they represent. However, in the connected molecules of metals and some liquids there exists a condition through which an ether stress can not be maintained, but is instantly equalized. In short, an electrical conductor is a substance which, on account of its molecular constitution and arrangement, cannot support the ether stress of a statical charge, while a non-conductor approaches the condition of the ether itself in this respect. A battery or a dynamo is simply a pump in its action for establishing these ether stresses.

When their oppositely-charged poles are brought into contact through a conductor, these tubes of stress are equalized through it. Fig. 4 is an endeavor to show what then occurs. A. B. represents a section of a conductor, to the ends of which are applied opposite statical charges by means of a battery or dynamo. The tubes of force through it are represented by the dotted arrows, with positive ends at B.

These stress tubes in equalizing rush forward from B towards A. As the ends sweep through the conductor, they drag along the surrounding ether, which, in consequence of its inertia, is set in motion, a motion of rotation represented in position and direction by the whirls C. and D.

Fig. 5 is a cross-section through the conductor and shows a magnetic whirl or tube of force set up by the sweep of the ends of the tubes. This apparent smoke ring has a clockwise rotation with reference to the sweep of the tubes and a screw-like motion, also clockwise looked at from B (fig. 4). These explanations may, in some respects, be looked upon as involving assumptions with regard to the motion of the ether and tubes of force which are not warranted from our present knowledge of them. However, the attempt to commit such known relations of fields of force, charges, etc., by means of mechanical conceptions cannot be wholly devoid of value, though it may be open to more or less criticism. It is only by proceeding from facts that are known and established to logical relations and representations that advancement is possible.

THE RAILROAD OF THE FUTURE.*

BY THEODORE VOORHEES.

When one considers the wonderful growth in the use of electricity during the past thirty years, it is impossible to say to what uses we may put it in the near future The electric light and the telephone are familiar in every village. The trolley car is rapidly extending its journeys so that soon it will pass each farmer's door. The steam railways are in some cases lighting their cars with incandescent lamps. Electricity is used for heating cars. At Baltimore an electric plant is rapidly approaching completion that is to provide power for an electric motor of sufficient capacity to move heavy trains through a tunnel half a mile in length. If this can be accomplished, may we not expect to see electricity ultimately supersede steam as the motive power of the locomotive? It will not do to declare it impossible; and yet it is very questionable if it will come in the near future. Electric lighting of passenger trains will doubtless come into general use as soon as a practical and reliable method is devised of generating the power from the axle of the car truck. But the expense involved in generating electricity in quantities sufficient to exercise a power equal to that of a first-class locomotive is so great that its use is at present impracticable. Possibly the future may develop some plan of drawing power directly from the rays of the sun. If, then, this power can be transferred into electricity and stored, there will ensue a revolution as great as when Watt first discovered steam. Then power will be limited, not by the cost and production of coal, but by the number of days of sunshine each year, and transportation will be brought within the means of all.

OPENING THE BALTIMORE TUNNEL.

On Feburary 1, the first regular scheduled train made a trip through the new Baltimore and Ohio Belt line tunnel, Baltimore, which is six miles long. It was the Philadelphia and New York fast freight, to which a passenger coach was attached for the accomodation of a party of railroad and electric experts.

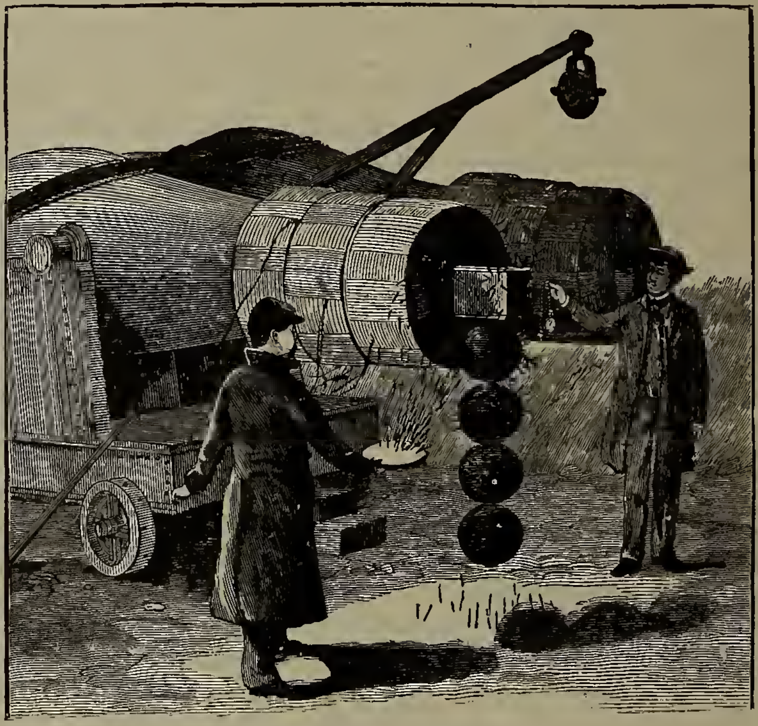
A cheer went up from the crowd around the tunnel approaches at Camden station when the train pulled out, and the spectators realized that the tunnel was at last doing something practical in the way of transportation. Work has been in progress on the tunnel for more than four years, and its completion has been expected for a long time. It cost the railroad company $7 000,000.

It is expected to have the electric apparatus finished by April 1, and the electric motors at work pulling trains through. After that time no steam-engines will be allowed to enter the underground passage way, which will be kept brilliantly lighted and clear from smoke. The tunnel will be of great value to the Baltimore and Ohio Company and to the travelling public, as the ferrying of trains across the bay at Canton will be done away with and passenger trains between Washington and New York will save from 20 to 30 minutes on their present schedule.

A HUGE MAGNET.

What is unquestionably the largest magnet on the face of the earth is that constructed of unused cannon at Willett's Point, N. Y., by Major W. R. King, of the U. S. Army.

Two 15-inch Dahlgren guns are placed side by side, the muzzles representing the poles of the huge magnet. The breeches of the guns are brought into metallic connection by the use of heavy iron plates, etc, placed across the intervening spaces. By this arrangement the conventional horseshoe magnet is simulated, and the usual magnetic circuit thus provided.



THE GREAT GUN MAGNET.

The muzzles of the guns are wrapped with old torpedo cables 14 miles long. A current of 20 to 25 amperes is sent through these coils and the magnetic effect is simply wonderful. The armature of this great magnet is made up of six platform plates bolted together. At a recent trial a pulling force of 44,800 pounds failed to tear the armature away from the magnetic embrace; the chain used in the pulling gave way, however.

The enormous magnetic power was demonstrated in various interesting and amusing ways. Five cannon balls, each weighing 325 pounds, were on one occasion suspended like a chain from one of the poles, and an iron spike placed against the breast of a man standing three or four feet away, with his back to the gun, stood out straight. It required the utmost strength of two men to pull a 25-pound bar of iron away from the gun. Watches were stopped when brought within three feet of the magnet, and metal masses of all sizes and shapes when brought within the powerful magnetic influence exhibited a strong tendency to get near the magnet and generally succeeded Spikes, and pins fairly rained toward the great centre of attraction.

Our illustration is reproduced from the *Scientific American* and gives some idea of the great power of this novel

* From *Engineering Magazine*, February, 1895.

magnet. The entire mass of iron, including guns, carriages, armature, etc., weighs over 130,000 pounds.

An interesting test showed that at a distance of 71 feet from the magnet the magnetism equalled that of the earth, a compass needle being deflected 45 degrees; and at a distance of 300 feet the needle was deflected three degrees.

A SUCCESSFUL EXPERIMENT.

A dispatch from Rochester, N. Y., February 2, states that an important experiment was made at the Citizens' Light and Power station in that city, on the date above mentioned.

The plant has three Westinghouse combined alternating current and direct current generators. These generators furnish an alternating two phase current from one side at an electro-motive force of 385 volts, which is raised to 2,000 volts on the line.

The other side furnishes a direct current at 500 volts. Until this experiment, the dispatch states, this type of machines has never, even in laboratory work, been run in multiple arc. On this occasion Expert W. S. Rugg, of Pittsburgh, connected the different phases of the alternating current of the three generators to single alternating current busbars and the direct current of the three machines to single direct current busbars, and operated the three generators in multiple arc in ordinary station practice

The result was extremely satisfactory to electrical engineers, as it demonstrated the practicability of operating this class of combined generators in multiple arc, with all that it implies Straight two phase alternators have been run in multiple arc in Europe, but never practically in this country.

Explosion in a Power-House.—A boiler in the Lawrence street power-house of the Denver Tramway Company, Denver, Col., exploded on the night of January 30, killing two men and injuring others. The entire building was wrecked, and the damage to the property amounts to $100,000.

ELECTRIC LIGHT PLANT IN KOCH'S DRY GOODS HOUSE.

One of the most complete isolated electric plants in New York City is that in the large dry goods establishment of H. C. F. Koch & Co., on 125th street.

This plant has several features that are worthy of a special notice. Besides being a fine example of electrical and mechanical work it includes a storage battery equipment for night lighting after the close of business.

On entering the main floor at night it is found to be brilliantly illuminated by arc lamps of elegant design made by the Electric Construction and Supply Company, of New York This company has installed in this one establishment a total of 76 of its celebrated arc lamps for constant potential circuits. All these lamps are of the ornamental "Knight" type. An illustration of this lamp is given herewith. The 76 lamps are distributed throughout the building as follows: 14 in the basement, 34 on the first floor and 28 on the second floor. The rest of the space is illuminated by incandescent lamps, for 1,200 of which the building is wired. All the wires are run in mouldings or on porcelain insulators.

INTERIOR VIEW OF KOCH & CO.'S STORE, SHOWING "KNIGHT" ORNAMENTAL ARC LAMPS.

We give a view of the interior of Koch's store, showing the arrangement of the arc lamps referred to. These lamps give a beautiful soft and steady white light, which is very satisfactory in places where colored goods and fine fabrics are dealt in. As they are of handsome design they are in perfect harmony with the elegant surroundings.

The storage battery plant consists of 58 cells; each of 700 ampere-hours capacity. They are placed in an enclosure by themselves and readily accessible for inspection, etc. They are the well-known chloride cells of the Electric Storage Battery Company, of Philadelphia, and have given the very best of satisfaction since their installation. They have given no trouble whatever, and they perform their work with the most satisfactory results. A saving of nearly 70 per cent. in gas bills is effected by the use of this battery plant.

The chloride accumulators are charged in the day time when the regular plant is in operation, and are used after

the steam plant has been shut down in lighting the various floors at night after the close of business hours. This plant, was installed by the Electric Storage Battery Company of Philadelphia.

In the installation of the regular plant, Mr. Charles H. Davis was the consulting engineer. There are two Thomson-Houston bi-polar generators, one of 240 amperes capacity and the other of 480, both at 110 volts. The generators are belted by cotton leather belts made by the Underwood Mfg. Co., to two Ideal high speed engines. The engines were installed by W. R. Fleming & Co., and are 13x12 and 10½x10 in size.

The wiring of the building was done at a loss of four per cent. at total load and the insulation bunched was over 50,000 ohms between poles and between either pole and ground. Grimshaw White Core wire, made by the New York Insulated Wire Co. of New York, is used throughout in the installation, except for the fixtures, where Bishop's Balata silk cord was preferred. Balata cords are made by the Bishop Gutta-Percha Company, of New York City.

The fixtures throughout the building were supplied by the Mitchell Vance Co.

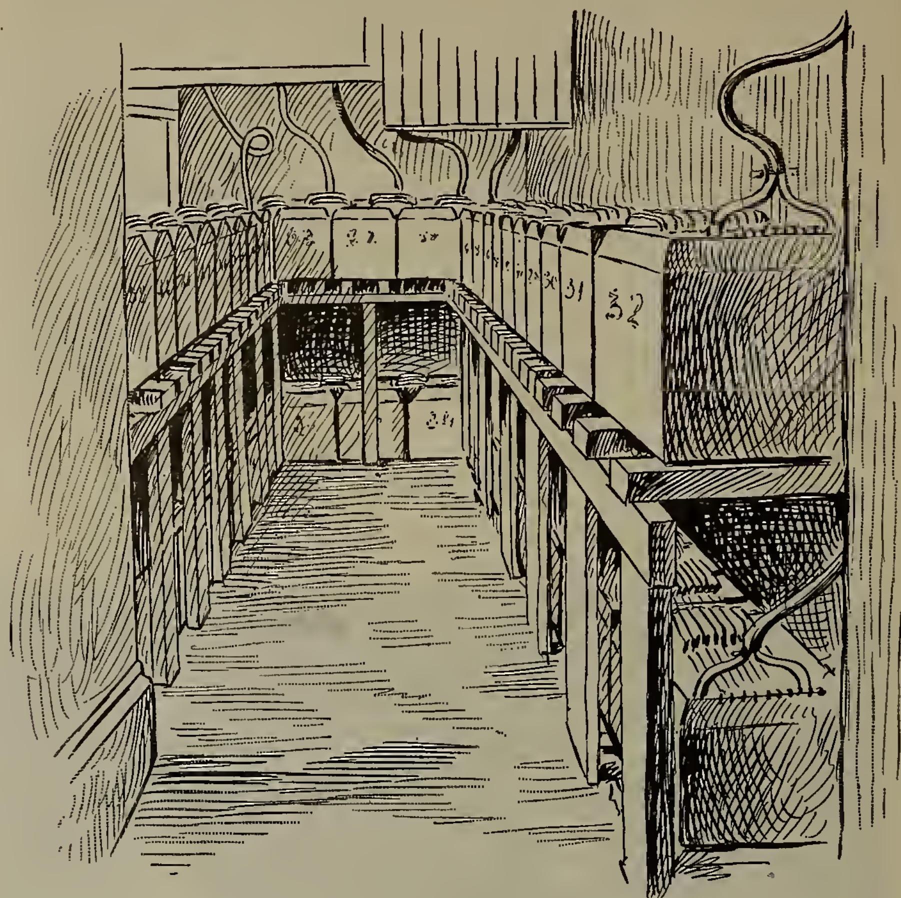
The main switchboard is of marbleized slate and is fitted with knife-blade and double-pole switches; Weston voltmeter and Thomson-Houston ammeters. The storage battery switchboard, also of slate, is so arranged as to effect various combinations of the cells. It was made by W. T. Pringle & Co., of Philadelphia. A small Crocker-Wheeler generator is used in the plant as a booster.

Take it all in all this plant is a model of completeness and reflects great credit upon all of the concerns represented in its installation.

THE LOAD FACTOR.

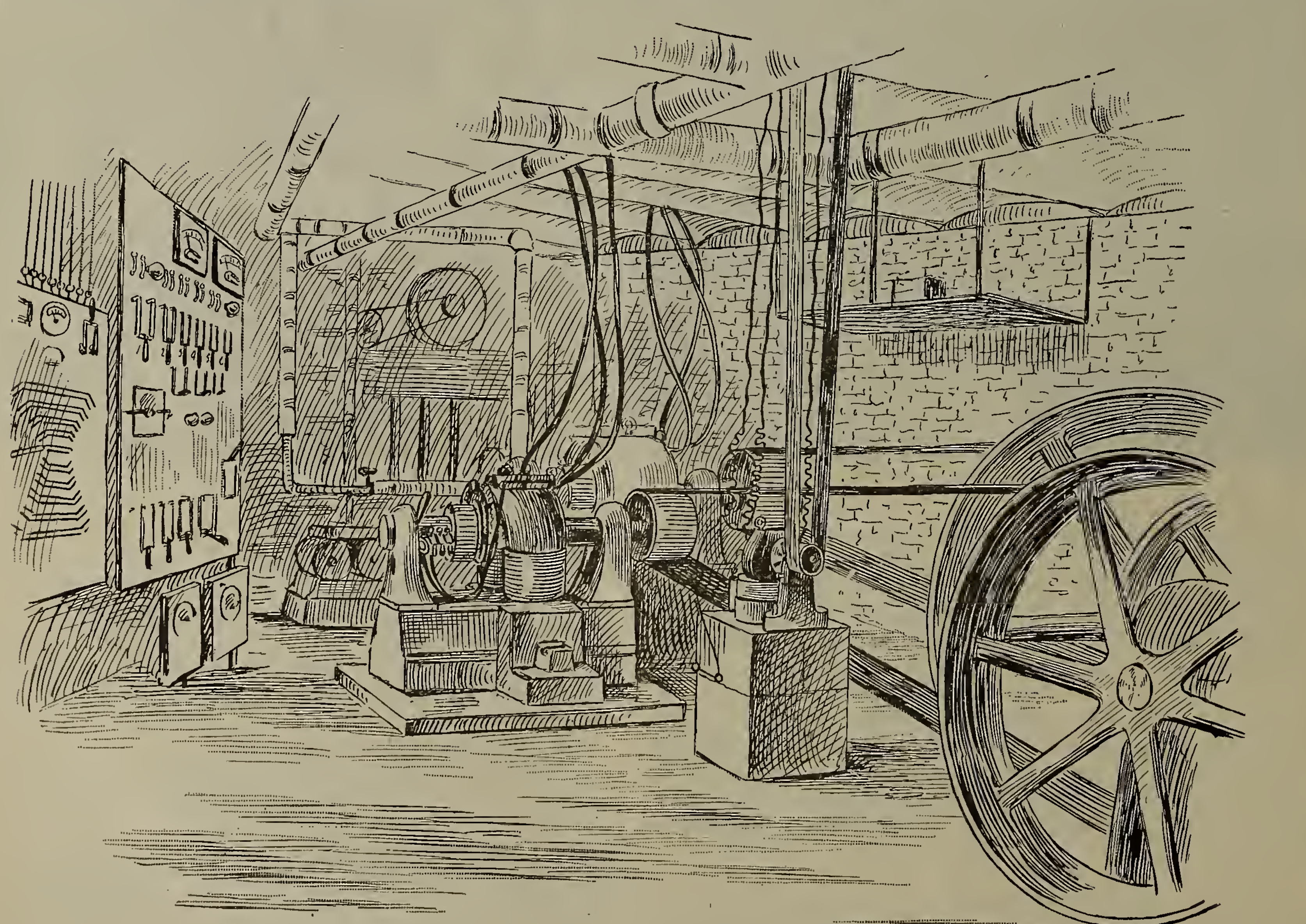
Mr. R. E. Crompton, the new president of the Institute of Electrical Engineers, London, delivered a lengthy inaugural address at the meeting of that institute on January 10, last. He reviewed the state of the electrical arts and industries and gave many interesting facts.

Referring to the subject of the "load factor," he said: "Not the lightest of the duties of the modern electrical engineer is that of educating the public in the use of electrical energy. This process, which we in this room call



CHLORIDE ACCUMULATOR PLANT IN KOCH'S DRY GOODS HOUSE, N. Y.

the improvement of the load-factor, is a matter of such importance to you all that I need not apologize for dealing with it at some length. We not only desire to have the output of our generating station more evenly distributed throughout the 24-hour day, so as to fill up the valleys and reduce the peaks of our daily diagram, but we also wish to improve the summer diagram as compared

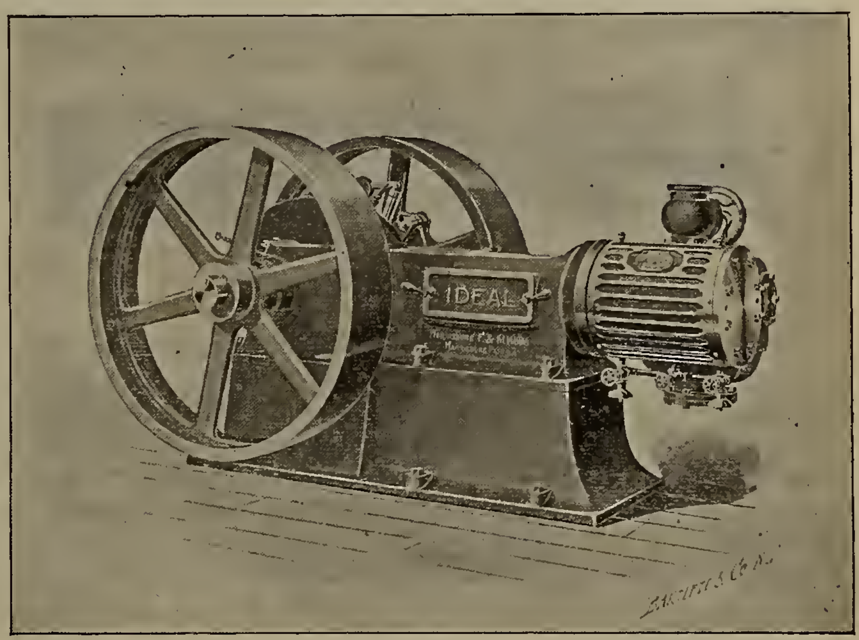


DYNAMO ROOM, KOCH & CO'S DRY GOODS HOUSE, NEW YORK CITY.

with the winter one. The problem of satisfactorily and economically working the daily diagram may be, to some extent, dealt with by improvements in the storage of electrical energy; but even if we were in possession of as satisfactory a system of electrical storage as the gas companies possess in their gasometers, it would only help us to this point. The great disparity between our winter and summer loads is due to our geographical position, and will always exist so long as the major part of the energy we supply is for lighting purposes, and the obvious remedy is to encourage its use for motive power and for heating and cooking; and to me at the present time it appears a far easier matter to educate the public to the advantages of using electricity for heating than to induce them to use

THE "KNIGHT" ORNAMENTAL LAMP USED IN KOCH'S DRY GOODS STORE.

motive power to any considerable extent. For this reason I have persistently advocated the perfecting of electric heating and cooking appliances. This matter has not been much understood even amongst electrical engineers themselves. For a long time the opinion was very generally held that the energy required for electric heating is so great that its cost would be prohibitive. At first it was not seen how effectively electrically-heated appliances could be used for cooking purposes, how large a proportion of the heat units would be usefully employed in cooking food, and how small a percentage would be wasted in heating surrounding air. Now that this result has been obtained, and that cooking operations on a considerable scale can be carried on in an ordinary sitting-room without perceptibly raising the temperature of the air of the room, it will be seen that electric cooking is certain to obtain popularity in hot climates, or in summer, or in small tenements, at such time when the lighting of fires and the waste heat from these fires is not only unnecessary but actually objectionable, and this even if the cost of the electrical cooking be considerably in excess of that by other means. At any rate, we may assume, if these expectations are only partially realized, that there will always be some sale of electricity for these purposes, and that the addition to our load diagram from such use will take the form of adding to it a parallel strip commencing from seven o'clock in the morning and ending at eleven o'clock at night, as I do not think there is anything in the condition of electric cooking to warrant anyone in thinking that the demand for energy for this purpose will be confined to the period immediately preceding each meal-time. The use of electricity for heating will be probably confined to the partial heating of rooms or parts of rooms which are required to be occupied for short periods or for the airing or warming of clothes or linen, and such use is also likely to be confined to the same hours as I have given for cooking.



IDEAL ENGINE, KOCH'S PLANT.

Turning now to the possible extension of the load from the use of motive power, we know how large a portion of the income of the American supply companies has been during the past two years obtained from its motor load, and that up to the present our motor load in England, at all events in London, has been insignificant. I have attempted to find out, by putting questions to the managers of the most important American electrical supply works, whether the habits of the American people, or the construction of the dwellings in which they live or of their business premises, was such as to cause a special demand for motive power which would never arise on this side. In putting these questions, I fully expected to hear that their large motor load would be chiefly attributed to the driving of elevators, to the ventilating of their rooms during their exceptionally hot summers, and to the working of special machinery necessitated by their lofty buildings; but I am told that this is not so, that many of the large hotels and larger blocks of buildings possess their own separate plant for working their elevator and other machinery, and that the bulk of the motor load of the electric supply stations is obtained from the buildings of a moderate size, and that in these the motors are used for small industries and for domestic work, both of which uses are likely to exist to an equal extent in London or in any large English towns. If this is the case, we may feel sure that the commercial enterprise of those amongst you who make and sell electric motors and the engineers of our supply companies who are so desirous of increasing their motor load will be sufficient to make it gradually approximate to the American one.

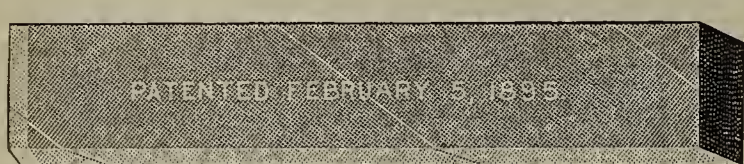
ELECTRIC POWER'S NEW FORM.

Electric Power has discarded its old form and assumed that of a magazine. The January number is the first under the new order of things, and it is exceedingly pleasing. It has 96 reading pages and is full of very interesting matter. A very valuable feature is the synopsis of current electrical literature, compiled by Max Osterberg, from the leading technical journals and magazines. An unwritten law requires monthly publications to take the magazine form, and we have no doubt that *Electric Power* will wax fat under its new guise. Horatio A. Foster is the editor and Max Osterberg associate editor, and under the direction of these two well-qualified gentlemen the publication cannot help being a "Power" in the electrical world.

THE PERFECTION DYNAMO BRUSH.

This brush is the latest competitor for public favor, and it seems to have all the qualities necessary to entitle it to generous support.

The "Perfection" brush is made of woven wire, the wire being woven over dies and then compressed by hydraulic pressure. It is made in continuous web, the proper lengths being afterwards cut off. It is flexible and adjusts itself to the commutator surface, thus insuring efficiency while reducing to a minimum the wear on the segments



PERFECTION DYNAMO BRUSH.

The brush is noiseless and contains no solder except at the extreme end. It is so constructed that there is no danger whatever of its unravelling and causing trouble. It is made from the finest copper and possesses the highest attainable conductivity. In addition to the other advantageous features, it is self-ventilating and reduces the sparking.

The Perfection brush is made by Mr. Chas. E. Chapin, 136 Liberty street, New York, and was patented on February 5 of this year.

GRADE CROSSINGS.

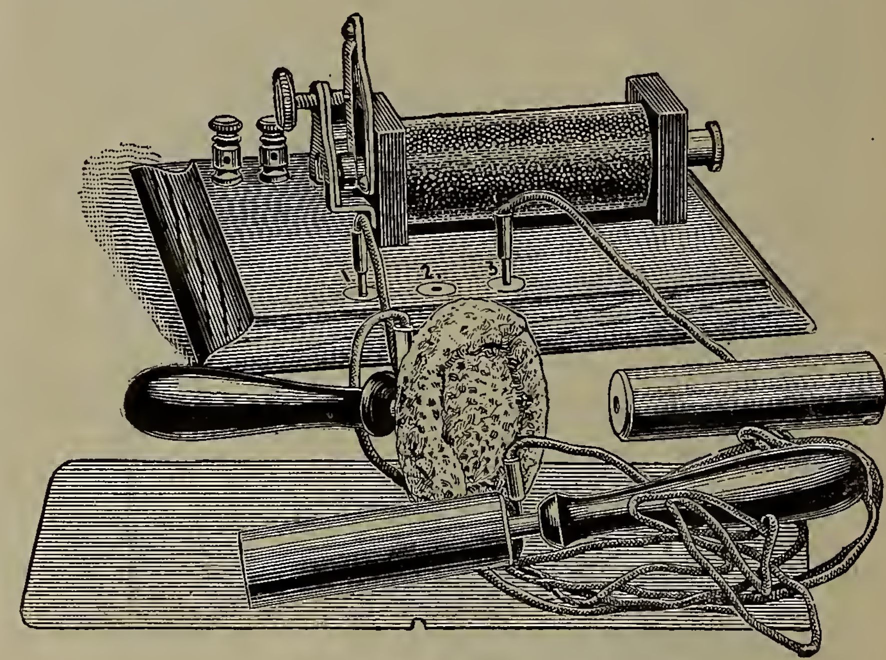
The present rapid multiplication of trolley-lines is increasing greatly the dangers of the grade-crossing. Competition with steam lines for suburban traffic is so keen that the trolley-lines run at high rates of speed. In consequence, accidents through failure to properly control the cars at crossings are not infrequent, and this lack of control may be said to have distinctly increased the danger to the public from all such crossings. Municipalities are very generally recognizing these facts, and in many directions plans are taking shape looking to the total abolition of all crossings at grade. Of almost equal importance are the arrangement and construction of the stations. They should be so planned as to make it unnecessary for any passenger to walk upon or across the tracks. The American public is self-reliant, accustomed to taking care of itself, and invariably rebellious against the introduction of gates, fences, foot-bridges, or tunnels intended for the safety of passengers. But at the same time it demands high speed, safety and punctuality, and it must in time conform to such wise regulations and arrangements as will insure the passage of all trains without the possibility of loss of life or limb.—Theodore Voorhees in *Engineering Magazine.*

BAD STATE OF AFFAIRS.—Coincident with the discovery in a certain city that the 2,000 candle-power arc lights are of only 800 candle-power is that the whiskey sold in its saloons is villainous.

ELECTRO-MEDICAL APPARATUS.

The accompanying illustrations show two styles of a family medical apparatus manufactured by J. Jones & Son, 67 Cortlandt street, New York. The smaller illustration is of the "Ideal Family Medical Set," and the larger of the "Perfection Family Medical Apparatus."

Both sets are constructed with the greatest care, and as simply as possible to avoid any confusion or doubt in using them in the family. All the metal parts are heavily



IDEAL FAMILY MEDICAL SET.

plated with nickel and the wood is highly polished. The sets are constructed upon the most approved principles, the vibrating spring being adjustable so as to control length and regularity of vibration. By this means a smooth and pleasant current is obtained, instead of an irregular, sharp and unpleasant sensation.

A complete set of electrodes comes with each outfit—

PERFECTION MEDICAL APPARATUS.

enough to apply electrical treatment in any and all cases.

The "Perfection" set includes a dry battery, which is a durable one and gives large current. A life of from six to twelve months is guaranteed according to use. When the

cell is exhausted it can be replaced by a new one at a nominal cost. The case enlosing the outfit is 7x9x5 inches in size, and the outfit complete weighs five pounds.

The "Ideal" set is a less expensive instrument, but as good as the "Perfection" in its working qualities. The only difference is that it is mounted on a polished wood base instead of being placed in a case. It works well with any cell or battery. The complete outfit includes all the accessories shown in the illustration.

THE "LOWEST BIDDER."

The following points of decisions will be of interest to our readers on account of their general bearing on the status of "lowest bidders" in some States :

Under the statute providing that cities of the third class shall award all contracts for printing to the lowest bidder, the performance of such a contract, if awarded to one who was not the lowest bidder, will be enjoined at the instance of a taxpayer, where the council merely finds that the one to whom the contract was awarded was the "lowest and best bidder," without finding any facts which rendered another, who was apparently the lowest bidder, not the lowest bidder in fact. Where the lowest bidder for city work, which is required to be awarded to the lowest bidder, is also a taxpayer, he may sue as a taxpayer to enjoin the performance of a contract awarded to a higher bidder, though his action is prompted by other considerations than his liability to excessive taxation.. Times Publishing Company vs. City of Everett.

In the case of the Vitrified Brick Company vs. Philadelphia, the question was whether the director of public works had no alternative but to award the contract "to the lowest bidder, who is able pecuniarily to carry out his contract." The court says : "This is a misconception of the law. This court has held that the word 'impossible' meant more than the pecuniary ability of the bidder to carry out the contract or to be answerable in damages for its breach, or to enter security for its performance, and the act vested in the officer. whose duty it was to award the contract, a discretion, and that his powers were not merely ministerial. The word 'responsible' applies not only to pecuniary ability, but also to judgment and skill. The duties thereby imposed on the city authorities are not merely ministerial, limited to ascertaining whose bid was the lowest and the pecuniary responsibility of the bidder and his securities. The act calls for the exercise of duties which are deliberate and discretionary."

AMBULANCE TROLLEY CAR.

An ambulance trolley car has been presented to the city of St. Louis by John Scullin, vice-president and general manager of the Union Depot R. R. Co. The furnishings and equipment supplied by the Health Department consist of eighteen plain folding chairs, twelve having arms and six without arms, all provided with rubber fenders, to prevent slipping and defacement of the woodwork. When in service it is proposed to man the car with a physician, who shall be known as Ambulance Surgeon, having equal rank to the Assistant Dispensary Physician. A male attendant, with the grade of day nurse, is to serve also with the car, besides a motorman to be designated by the Union Depot railway company, both in uniform and under the orders of the surgeon while on duty. A time card will be prepared and published in order that the police and public may know when the car will be due at a given street or designated point, enabling patients to be delivered aboard the car with little handling or delay.

Prices for Electric Light in Brooklyn.—The prices paid for electric lighting in Brooklyn this year are as follows: each arc light per night, 1,200 candle-power, 40 cents ; incandescent 16 candle-power, 1,000 watts, meter measurement, 20 cents. One bid on incandescents was $\frac{8}{10}$ cents per light per hour.

FAVOR HOME INDUSTRIES.

After considerable see-sawing the Allegheny (Pa.) Council awarded the lighting contract to the Westinghouse Company, because it is a local company, though its bid was not the lowest. But Mayor Kennedy vetoed the ordinance, his veto was sustained, and a resolution was at once introduced ordering that the contract be given to the lowest bidder. Mayor Kennedy said : "When Allegheny City advertised for proposals under our own specifications for this work, we invited bids from all over the country, and parties came here from other cities, at a great expense of time and money, and bid in good faith on this contract, expecting such honorable and just treatment as was due them by the city. I fully believe that when all things are equal that the home companies should always receive the preference, but such is not the case in this contract. There are two lower bids than the Westinghouse Company, both reliable companies with established reputations, and whose lights are successfully used in other cities. These companies have complied with our specifications as to character of bond and stand ready to do the work."

THE CLEVELAND CONVENTION.

Secretary Geo. F. Porter informs us that in addition to the papers and topics heretofore given for the Cleveland programme, there will be a paper entitled "A New Method of Measuring Illumination," by Professors E. J. Houston and A. E. Kennelly.

Topic : Underwriters' Rules vs. National Electric Light Association Rules.

Topic: Practical Demonstration of Protecting Lines from Lighting ; A. J. Wurtz.

The entire programme for the convention is now completed.

C. O. Baker, Jr., master of transportation for the National Electric Light Association, has completed preparations for a special train to the Cleveland Convention, on February 19, 20 and 21. Arrangements have been made with the New York Central & Hudson River R. R. Co. for a special train of Wagner vestibule, parlor, dining room and buffet cars, leaving the Grand Central depot, 42nd street, New York, at 9:30 A. M., Monday, February 18, and running as the second section of the fast mail on the following schedule :

Leaving New York	9:30 A. M.,	Eastern Time.
" Albany	1:00 P. M.,	"
" Utica	3:17 "	"
" Syracuse	4:40 "	"
" Rochester	6:30 "	"
" Buffalo	7:25 "	Central Time.
" Erie	9:33 "	"
Arriving at Cleveland	11:55 "	"

Seats can now be secured on this train by applying in person or by letter to the office of the National Electric Light Association.

A special rate has been granted (on the certificate plan) of a fare and one-third from all points in the United States east of the Mississippi River, Peoria, and Chicago, Ill., to Cleveland. To obtain this rate it is necessary in purchasing *going* tickets to ask the ticket agent for a certificate, which, when properly vised and endorsed at Cleveland, will entitle the purchaser to a one-third fare returning.

That the best results may be obtained, it is very desirable that delegates should make their application for space on the New York special at the earliest possible moment.

The following gentlemen have charge of transportation in their respective districts, to whom application can be made for all information.

A. C. Shaw, 620 Atlantic avenue, Boston, Mass.; H. A. Cleverly, 1018 Chestnut street, Philadelphia, Pa.; E. H. Heinrichs, Westinghouse Electric Co., Pittsburgh, Pa.; F. L. Powers, Monadnock Building, Chicago, Ill.

LECTURES ON ELECTRO-THERAPEUTICS.

Mr. A. E. Kennelly, of Philadelphia, will deliver a course of ten weekly lectures at the Academy of Medicine, 19 W. 43rd street, New York, beginning about the third week in February. The subject of the lectures will be "Physical Elements of Electro-Therapeutics," and it will be divided and classified as follows:

1. Electricity and Electrical Energy: Introductory. 2. Electromotive Force, Laws and Generation: Voltaic Batteries, Primary and Secondary. 3. Electromotive Force: Static and Influence Machines. 4. Resistance.—Laws and Measurement: Adapters and Rheostats. 5. Electric Current, Laws and Measurement: Ammeters and Voltmeters. 6. Effect of Electric Currents: Cataphoresis, Heating, Electrolysis. 7. Magnetism: Dynamos and Motors. 8. Effects of Magnetism: Faradic and Induction Coils. 9. Alternating Current of Low Frequency: Sinusoidal Currents. 10. Alternating Currents of High Frequency: Static Induced Currents.

The lectures will be illustrated by oxy-hydrogen lime light, with lantern slides, principally of original character, and suitable experimental apparatus.

THE STANDARD UNDERGROUND CABLE CO.'S NEW OFFICERS.

On January 26, 1895, the Board of Directors of the Standard Underground Cable Company held its first regular meeting after the annual stockholders' meeting of January 22, and elected the following executive officers of the company for the ensuing year:

George Westinghouse, Jr., president; Joseph W. Marsh, vice-president and general manager; Frank A. Rinehart, secretary and treasurer; Charles M. Hagen, auditor.

At the annual meeting of the stockholders, Joseph W. Marsh was also re-elected as one of the directors in the company. Mr. Marsh is now entering upon the fourteenth year of his connection with this successful corporation, during most of which time he has been its general manager.

THE CLEVELAND CONVENTION.

Things are stirring in the trade in view of the Cleveland Convention on the 19th, 20th and 21st instants. There will be a large attendance, and the enthusiasm will likely be as large. There are lots of practical papers and discussions on the programme, and those who attend will hear something of practical value. Cleveland is an interesting city and unequalled as a meeting place. It is a large electrical centre, and there is plenty to see and interest. The birthday of the gentleman who couldn't tell a lie when he was young immediately follows the convention. The members should stay in Cleveland and celebrate the event.

A. I. E. E. MEETING POSTPONED.

On account of conflicting dates with the convention of the National Electric Light Association, at Cleveland, February 19, 20 and 21, the regular monthly meeting of the American Institute of Electrical Engineers, at New York and Chicago, have been postponed from February 20 to Wednesday, February 27, 1895.

The paper to be presented on the latter date is by Mr. H. Ward Leonard, entitled: "Notes on Recent Electrical Engineering Developments in France and England," being the result of the author's recent personal observation in electric light, railway, central station and underground practice.

Notoriety.—Inspector Williams, of New York, says he is so well known in New York that even the street-car horses nod to him.

A Telephone Concert.—They are having high old times in Szegedin, and Szabadka. A telephone concert was given recently in Temesvar, Hungary, the audience listening to a military orchestra playing at Arad, duets and songs in Szegedin and a chorus in Szabadka, besides songs by celebrated artists in three different theatres in Buda-Pesth. After the concert a ball took place, the young people dancing to the music from the various places mentioned. It is believed, says the London *Standard*, that no such concert ever before took place in Europe.

Notes of General Interest.

It is reported that the Delaware Valley Electric Railroad, Stroudsburg, Pa., has gone into the hands of receivers.

The plant of the Danville Electric Light Co., Danville, N. Y., it is reported, has been sold on foreclosure.

A telephone line is to be constructed between Boulder, Col., and the mountain camps in that vicinity. E. M. Burgess, general superintendent of the Denver Telephone Company, can give further information.

It is stated that the Point Defiance Railway, Tacoma, Wash., has been sold to S. Z. Mitchell, of Portland, Me., and that the road will be consolidated with the Tacoma Railway and Motor Company's lines. It is further stated that the General Electric Company controls the entire deal.

The Tiptop Mining Co. has purchased the Gilman electric plant, Gilman, Col.

The Portsmouth Electric Light Co., of Portsmouth, N. H., has been awarded the contract to light the city by electricity for five years at the rate of $115 each for arc lights per year.

It is reported that the Auburn Street Railway, Auburn, N. Y., has been sold to New York capitalists. The consideration is stated to be about $100,000.

The South Orange Township Committee, South Orange, N. J., is considering an additional section to the ordinance covering the Springfield avenue franchise, now being considered by that body. The section provides in part "that, in case of any dispute arising between this company and its employés in relation to wages or anything else, in order that the convenience of the public may not be interfered with, it is hereby provided that the said company shall, pending the settlement of questions involved, continue to operate its road on the full schedule time then existing, on the same basis of wages and under the same conditions that were in force at the time the disputed point or points arose."

Telephone Notes.

Pocomoke City and Snow Hill, Md., are to be connected telephonically.

A telephone exchange is to be established in Westminster, Md.

Hattiesburg, Miss., and points in the vicinity will likely soon be connected by telephone.

New Telephone Companies.—Fisherville, Barter Brook and Stuart's Draft Telephone Co., Fisherville, Va.

Roanoke Telephone Co., Roanoke, Va., (for further particulars see possible contracts.)

TELEPHONE PATENTS ISSUED JANUARY 29, 1895.

Telephone System—John I. Sabin and William Hampton, San Francisco. (No. 533,142.)

Telephone Switchboard Apparatus—Charles E. Scribner, Chicago, Ill. (No 533,147.)

Possible Contracts.

The Philadelphia, Castle Rock and Westchester Railway Co. will build a power house near Llanerch Station, Pa.

Edward Kendal & Sons, Cambridge, Mass., contemplate extensive enlargements of their plant.

The Newton Street Railway Co., Waltham, Mass., has been granted the right to extend its lines through Crescent Park to Forest Grove.

The Media, Middleton and Aston Electric Railway Co., Chester, Pa., will commence construction work in the near future.

An electric railway is to be constructed between Apex and Canonsville, Delaware Co., N. Y.

There is talk of constructing an electric railway between Auburn and Port Byron, N. Y.

The fire alarm boxes in Indianapolis, Ind., are to be substituted for more modern ones.

An effort is being made in Sweet Springs, N. J., to establish an electric light plant and water-works in that place.

The business men of Wausaw, Wis., are making an effort to establish a telephone system in that place.

The Bergen Co. Traction Co. has asked the Road Commissioners of Hackensack, N. J., for a franchise for a trolley road.

A ten-story building is to be erected in Buffalo. W. H. Burnham is the architect, and can give further information. The electricity to be used will be transmitted from Niagara Falls.

It is reported that the South Sioux City and Covington Street Railway, Sioux City, Ia., will extend its lines and will introduce electricity as the motive power.

A telephone exchange is to be established in De Soto, Mo.

A power-house is to be erected in Mt. Washington, Md., by the Mt. Washington Electric Light & Power Co.

An electric light plant is to be established in Lynchburg, Va. David C. Evans, electrical engineer, Baltimore, can give further information.

The Blue River Mineral Co., in Ivanhoe, Va., wants an electric dynamo and all the necessary equipment for eight arc lights.

There is talk of establishing an electric railway in Kent, O.

An electric light plant is to be established in Newberg, Ore.

A telephone exchange is to be established in Springfield, Mo., to run to several of the adjacent towns.

The Drake & Stratton Co., Columbus, Ga., has been granted a charter for the construction of electric roads in Phoenix City.

The People's Traction Co., Philadelphia, Pa., will build a new power-house at Ogontz, Pa., and extend its lines to Jenkintown.

It is reported that an electrie road is to be built between Saratoga and Santa Clara, Cal., via San Jose. The length of the road will be 12 miles.

The Electric Street Railway Company in Jackson, Tenn., will supply that place with electric lights for streets and inside lighting.

The Crosstown and Belt Electric Railroad, Manchester, N. H.

Wm. S. Doolittle, Utica, N. Y., Chas. I. Williams, Thos. N. Mooney will organize a company to furnish light, heat and power to the city of Utica.

The Trenton Passenger Railway Co., Trenton, N. J., has planned to extend its line to Princeton and Bordentown at an early date.

The Electric Light Company in Normal, Ill., contemplates the remodelling of its plant during the summer. Improved machinery and engines will be put in.

The Portland Street Railway Co., Portland, Me., proposes to introduce electricity on its line. Mr. Wm. R. Wood is president.

There is talk of building an electric railroad from Greenville to Coxsackie, N. Y., a distance of 13 miles.

Efforts are being made in Brockton, Mass., to organize a new co-operative electric light company.

A bill has been introduced in the Maine legislature to incorporate the York County Electric Railroad Co., with a capital stock of $1,000,000. W. A. Roberts, Edgar A. Hubbard and others are the incorporators.

Frenchtown, N. J., is ripe for an electric light plant.

There is talk in Stratford, Conn., of introducing water and electric lights in that place.

The Scottdale, Evanson and Bradford Electric Railroad Co., Scottdale, Pa., proposes to extend its lines at an early date.

There is a movement on foot by New York capitalists to build an electric railroad between Oxford and Newark, Del. The Oxford Board of Trade can give further information.

The Reading and South-Western Electric Railroad Co., Reading, Pa., proposes to extend its lines in Reading.

An electric light plant is to be established in Phœnixville, Pa.

The Le Roy Hydraulic Electric Co., Le Roy, N. Y., proposes to supply electricity in that place for light, heat and power.

E. S. Corson and others have been granted a franchise in Springfield, O., for an electric railway between that place and Clifton.

Mayor G. W. Swartz, of Florence, Ala , can give information regarding the proposition to utilize water power in that place for the generation of electricity.

Salade's candle factory in Havana, N. Y., was destroyed by fire recently. Loss $100,000.

R. Hey & Sons, Manayunk (Philadelphia), Pa., will build a large addition to their woollen mills.

The Cre cent Mfg Co., Detroit, Mich., contemplates the erection of a plant in Muskegon, Mich., for the manufacture of hoops, headings, staves, etc.

Henning & Sons, Mendota, Ill., are the contractors for the rebuilding of the brewery recently destroyed by fire in that place.

Colonel F C. Robinson, Blaine, Me., is talking of introducing an electric light plant in that place.

An election is to be held in Tecumseh, Mich , on the proposition to issue bonds to establish an electric light plant. Further particulars can be obtained from W. J. Ingersoll, recorder.

An electric light plant is to be established in New comerstown, O.

There is a movement on foot in Greeley, Col., for the organization of a company to supply electric light and power for the city.

A police alarm system is to be introduced in Birmingham, Ala. The Mayor of that city can give further information.

Dothen, Ala., has applied for authority to issue bonds for water-works and to build an electric light plant. The Mayor can give further particulars.

A capitalist of Arkansas has applied to the Council of Fulton, Ky., for an electric light franchise.

There is talk of constructing a telephone line between Snowhill and Pocomoke City, Md.

R. B. Hazlett, Westminster, Md., is endeavoring to establish a telephone system in that place.

E. C. Chapman, Columbus, Ga., can give particulars regarding a proposed electric light plant in that place.

J. C. Blackburn, Hattiesburg, Miss., is interested in plans to build a telephone line in that place and vicinity.

The Chattanooga, Electric Light and Power Co., Chattanooga, Tenn., has applied for a charter. The incorporators are D. J O'Connell, F. F. Wiehl, Foster V. Brown, Frank Spurlock and John B. Nicklin. This is a reorganization of the Chattanooga Electric Light Co.

There is talk of building an electric light plant in Cape Charles, Va.

The Mayor of Martinsburg, W. Va, can give information regarding a proposed electric light plant in that place.

A large hotel is to be built in Berkeley Springs, W. V., by New York parties. Further particulars can be obtained from Daniel Cornelius, Berkeley Springs.

A new cotton palace is to be built at once in Waco, Texas. It will cost $100,000. It will be constructed of steel and brick.

It is reported that a company is being organized in Anniston, Ala., to build an electric road from that place to the St. Clair coal fields, a distance of 20 miles.

A movement is on foot in Monticello, Ky., to organize and build an electric railroad to Burnside, Ky. F. H. Bagley and J. W. Tuttle of Monticello, are interested.

The Charlottesville, Va., Electric Street Railroad Co., Charlottesville, Va., has purchased the only horse car line in that city and will substitute electric power thereon.

The Taunton Electric Co, Somerset, Mass, has been granted a franchise for an electric road.

The American Magneto Company of Chicago, Ill., will establish a telephone exchange in Frankton, Ind.

There is talk of establishing an electric light plant in Rolla, Mo.

E C. Chapman, Columbus, Miss., can give information regarding the establishment of an electric light plant in that place.

New Corporations.

The Tri-State Telephone and Telegraph Co., Cincinnati, O., by M. S. Forbus, Chas. W. Baker and others. Capital stock, $250,000.

The Oakland Railway Co., Royal Oak, Mich., by Geo. Hendrie, Stratheam and others. Capital stock, $50,000.

The E. S. Karoly Electrical Construction Co., Chicago, Ill., by E. S. Karoly, V. Merriman and J. H. Weber. Capital stock, $12,000.

American Bureau of Electrical Engineering Information and Employment, Chicago, Ill., by Clinton E. Woods, Francis E. Drake and P. Malben. Capital stock, $1,000,000.

The Snoqualmie Falls Electric Power Co., Snoqualmie Falls, Wash. Capital stock, $2,000,000.

The Natick Gas and Electric Co., Natick, Mass., by Guy Wilkinson, president; Arthur E. Appleyard, treasurer, and Clayton W. Wilkinson. Capital stock, $125,000.

The Vicksburg Electric Light Co., Vicksburg, Miss., by Joseph Hirsch, Chas. F. Armstrong and others. Capital stock, $125,000.

The City Suburban Electric Railroad Co. of Manchester, Manchester, N. H.

The Westchester County Central Electric Railway Co., White Plains, N. Y. Capital stock, $75,000

The Rawson Electric Co., Elyria, O., by H. C. McKinley, J. B. Coffinberry and T. M. Brush. Capital stock, $50,000.

The Molyneux Electric Manufacturing Co., Buffalo, N. Y., by W. W. Webb, New York, F. Hammond, J. P. Triblo and others. Capital stock, $30,000.

The Central Wisconsin Electric Railway Co., Oshkosh, Wis., by G. F. Kedham, G. J. Jobusch, Otto Von Schrader and others. Capital stock, $1,000 000.

The General Electric Railway, Chicago, Ill. Capital stock, $5,000,000.

The Fisherville, Barterbrook and Stuart's Draft Telephone Co., Fisherville, Va., by J. W. Paul, P. T. Burkholder, W. F. Gilkeson and others.

The Roanoke Telephone Co., Roanoke, Va., by Ballard P. Huff, president; W. E. Deaton, vice-president, and W. K. K. Andrews, secretary and treasurer. Capital stock, $25,000.

The Gulf Coast Electric Railway Co., Biloxi, Miss., by A. M. Dahlgren, of Biloxi, and James B. Cable, of Long Beach.

An electric light company, by John McElhany, with a capital stock of $10,000.

The People's Traction Co., of the City of New York, by Franklin A. Wilcox and Edward H. Hobbs, of New York, John A. Bensel, of New York, and Martin Keogh, of New Rochelle. Capital stock, $1,500,000.

The Westchester County Central Electric Railway, White Plains, N. Y., by Chas. A. Johnson, Fred. H. Reed, of New York City, and J Henry Carpenter, of White Plains, N. Y. Capital stock, $75,000.

The Universal Engineering Co., Baltimore, Md., by G. W. F. Vernon, T. F Wilcox, W. J. King, Julius Stern and Leopold Stern. Capital stock, $10,000.

Mutual Automatic Telephone Co., Chicago, Ill., by A R. Mackin, Joseph Kelly and Jas. F. Duhig. Capital stock, $1,000,000.

The Chardon Telephone Co, Chardon, O., by Grange Pomeroy and others. Capital stock, $2,000.

The Lorain & Wellington Railway Co., Lorain, O., by H. G. Reddington and others. Capital stock, $100,000.

The Central Wisconsin Electric Railway Co., Oshkosh, Wis. Capital stock, $1,000,000.

The Chattanooga Light and Power Co, Chattanooga, Tenn., by D. J. O'Connell, F. F. Wiehl, Foster V. Brown, Frank Spurlock and John B Nicklin.

The Roanoke Telephone Co., Roanoke, Va., by Ballard P. Huff, president; W. E. Deaton, vice president; W. K. K. Andrews, secretary and treasurer. Capital stock, $25,000.

The Individual Telephone Directory Co., St. Louis, Mo. Capital stock, $3,000.

The Metropolitan Register Co., New York, N. Y., by J. H. Carson, John B. Benton and Joseph M. Stoughton. Capital stock, $10,000.

The Nikola Tesla Co, New York, N. Y., by Edward B. Adams, 17 Nassau street, N. Y., Chas. F. Coadey, of Summit, N. J., and others. Capital stock, $5,000.

The Boynton Multivolt Battery Co., Brooklyn, N. Y., by E. S. Boynton, of Brooklyn, Abraham Strauss, Peter Kemble, N. Y, and others. Capital Stock, $10,000.

The Suburban Telegraph Company, of Westchester, N. Y., capital, $10,000. Directors: William Bryant, James McCullom, Thomas P. Tighe, Thomas Conlon, Michael McGonigle, George E. Shepard and Thomas Lloyd, of New York City.

THE BROOKLYN STRIKE.

The cars on most of the Brooklyn lines are running with fair regularity, although the situation is not yet settled. There are frequent but unorganized outbreaks of violence on the part of the strikers and their sympathizers, but the police are now able to handle these cases. All the troops have been withdrawn, and the city authorities are now held responsible for the preservation of peace. The strike is unquestionably at an end; the strikers have lost and the companies have not been compelled to surrender their position. True, the latter have been seriously embarrassed in their efforts to get new men to take the places of the strikers, but they seem to be gradually bringing about the normal condition of things. Even yet they are not experiencing the greatest of ease in getting new men. This probably is due more to fear on the part of the would-be employés rather than to scarcity of labor, for every one knows that there are plenty of men out of work. Skilled motormen are of course not easy to find by the wholesale, but the companies seem to be doing quite well. There are some accidents, due to inexperience on the part of the motormen, and the strikers are making the most of these cases. They are making legal attacks on the companies on every possible ground, and the railroad officials are having lively times in defending their positions. The strikers are evidently going to make it as unpleasant for the railroad companies as they possibly can through the medium of the courts.

PRINCIPLES OF DYNAMO DESIGN.

The instalment of this article intended for this issue has been unavoidably omitted. It will appear in our next issue.

New York Notes.

Office of the Electrical Age,
World Building, New York,
February 4, 1895.

Bateman & Miller, 143½ East 23d street, New York City, are kept very busy on general electrical contract work and wiring. They are installing a complete incandescent plant in the New York College at the corner of 23d street and Lexington avenue. The plant will be wired for 250 lamps and will include one General Electric dynamo, fixtures, wiring, cut-outs, switches, Grimshaw wire, Whitney switchboard instruments and slate switchboard.

James F. McCartney has been appointed receiver for the New York Electrical Manufacturing Company, formerly at 154 West Twenty-seventh street, on the application of Archibald C. Shenstone, under a judgment for $219.

Wallace & Sons' brass and copper rolling mills, 29 Chambers street, New York City, will soon have their new catalogue for 1895 ready. This catalogue will contain the latest revised price lists of their well-known goods.

The Imperial Electric Lamp Company, 253 Broadway, New York City, is meeting with excellent success with its lamps, and wherever these lamps are given a fair competitive test on trial, the order is always assured. The company has never yet taken out a lamp, after being once put in on trial. The Imperial lamp is not a cheap lamp, but is cheap in the end. All parts are made in a skilful manner and perfectly finished. These lamps burn evenly and never flicker or splutter, holding the light steady throughout the life of the carbons. One of this company's customers recently stated in a letter to the company that he now only used 5-H. P., getting 4000 C. P. from the Imperial Lamp, whereas it took 10-H P. before for 1920-C. P.

The Sprague-Pratt Electric Elevator Company, of this city, has been awarded the contract for the new elevators for the Custom House in this city.

Chas. Hinds, Hudson and 13th streets. New York City, the well-known manufacturer of gas lighting appliances, is doing a good business. He is the oldest maker of static electric machines and burners for multiple lighting systems. He has recently introduced a new material for multiple gas lighting burners. It is not affected by heat and is a perfect non-conductor of electricity. Every one needing supplies in this line should communicate with Mr. Hinds.

The Claus dynamos and generators made by P. Claus, 333 East 107th street, are very popular. Mr. Claus has a good many testimonials from users regarding the high qualities of the machines. It is claimed, in many cases, that 25 per cent. more current can be generated by these dynamos than the contracts call for. Mr. Claus's trade is rapidly increasing and the machines are very extensively used. W. T. H.

Trade Notes.

The Metropolitan Electric Co., Chicago, has just taken the agency for the American Carbon Company's products and will carry a full line of this celebrated carbon. They will have their stock in in a few days and will be able to meet the demands of the market. This adds another high class specialty to the Metropolitan Company's list.

The Wallace Electric Company, Chicago, is doing a large trade in the celebrated Work brushes. These brushes are giving unqualified satisfaction to all users, and when they are once tried their use is never discontinued. They are made of a combination of metals and embody all the essential qualities of a perfect brush This brush was invented by Mr. Charles Work, one of the experts of the old Edison Company, and is sold by the Wallace Electric Company, who is doing a large business in this specialty.

Underground Conduit.—The National Conduit Mfg. Co. has laid in the United States no less than 15,000,000 feet of conduit for carrying the wires and cables of telephone, telegraph, electric light and electric railway companies. Ninety five per cent. of all the conduits used, it is stated, were installed by this company, which has its offices in the Times Building, New York City. They claim to be the only concern that can install the conduit system successfully, having skilled engineers and workmen who thoroughly understand their business.

WOVEN WIRE BRUSHES.

The Belknap Motor Co., of Portland, Maine, are the patentees and manufacturers of the best woven wire commutator brush on the market.

ELECTRICAL and STREET RAILWAY PATENTS

Issued January 29, 1895.

533,041. Car-Fender. Robert Atherton, Paterson, N. J. Filed Sept. 24, 1894.

533,050. Safety-Guard for Cars. William B. Champlin, Jr., Oak Cliff, Tex. Filed May 22, 1894.

533,078. Primary Battery. Richard O'Toole, Mechanicstown, assignor of one-half to George W. Smith, Baltimore, Md. Filed Aug. 3, 1893.

533,083. System of and Apparatus for Controlling Electric Circuits William B. Potter, Lynn, assignor to the General Electric Company, Boston, Mass. Filed July 24, 1893.

533,096. Car-Fender. Hermann Stephan, Jersey City, N. J., and John Schütz, New York, N. Y., assignors of one-half to George F. Of and Julius Weinstock, New York, N. Y. Filed Sept. 15, 1894.

533,100. Electric-Arc Lamp. Hans O. Swoboda, New York, N. Y., assignor to the General Incandescent Arc Light Company, of New York. Filed Mar. 2, 1894.

533,107 Electrical Measuring-Instrument. Edward Weston, Newark, N. J. Filed Mar. 11, 1891.

533,108. Electric Motor. Charles Wirt, Chicago, Ill. Filed Apr. 23, 1894.

533,142. Telephone System. John I. Sabin and William Hampton, San Francisco, Cal.; said Hampton assignor of one-fourth of the whole right to said Sabin. Filed Apr. 14, 1894.

533,146. Apparatus for Smoothing Currents of Dynamo-Electric Machines. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Jan. 16, 1892.

533,147. Telephone Switchboard Apparatus. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed May 13, 1892.

533,154. Circuit-Closer for Railway-Rails. Edgar C. Wiley, Bristol, Tenn., assignor to the Wiley Railway Electric Signal Company, same place. Filed May 29, 1894.

533,183. Automatic Electric Signal. Henry C. Storrs, Hartford, Conn., assignor of one-half to Edward R. Faxon, same place. Filed Apr. 20, 1894.

533,196. Combined Portable Stand and Wall-Bracket for Incandescent Electric Lamps. Herman Horn, Philadelphia, Pa. Filed Feb. 15, 1892. Renewed June 29, 1894.

533,211. Electric-Arc Lamp. Eugen Conrady, Keighley, England Filed Dec. 16, 1893. Patented in England, Jan. 13, 1893, No. 775.

533,223. Incandescent Electric Lamp. George R. Lean, Cleveland, Ohio. Filed Nov. 29, 1893.

533,242. Track-Sanding Apparatus. Martin S. Starkweather, Boston, Mass. Filed Nov. 26, 1894.

533,244. System of Distribution by Alternating Currents. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company, of New York. Filed Apr. 2, 1894.

533,245. System of Electrical Distribution. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company, of New York. Filed April 13, 1894.

533,246. Winding for Dynamo-Electric Machines. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company, of New York. Filed July 14, 1894.

533,247. System of Electrical Distribution. Charles P. Steinmetz, Schenectady, N.Y., assignor to the Thomson-Houston Electric Company, Boston, Mass. Filed Sept. 24, 1894.

533,248. System of Electrical Distribution. Charles P. Steinmetz, Schenectady, N.Y., assignor to the Thomson-Houston Electric Company, Boston, Mass. Filed Sept. 24, 1894.

533,249. Monocyclic Motor. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company, of New York. Filed Nov. 20, 1894.

533,250. Monocyclic Motor. Charles P. Steinmetz, Schenectady, N. Y., assignor to the Thomson-Houston Electric Company, Boston, Mass. Filed Nov. 24, 1894.

533,259. Electric Locomotive. S. Lloyd Wiegand, Philadelphia, Pa. Filed Oct. 23, 1890.

533,261. Bonding Device for Electric Railways. John J. Zimmele and Antoine Bournonville, Philadelphia, Pa.; said Bournonville assignor to said Zimmele. Filed Nov. 30, 1894.

533,263. Safety-Guard for Street Cars. Andrew P. Anderson, Wilkinsburg, Pa. Filed Oct. 16, 1894.

533,269. Recording Ampere-Metre. William H. Bristol, Hoboken, N. J. Filed July 26, 1894.

533,270. Electrical Measuring Instrument. William H. Bristol, Hoboken, N. J. Filed Sept. 24, 1894.

533,318. Controller or Switch for Electric Motors. William J. Pohlman, Woodbrook, assignor of one-half to J. Edgar Orrison, Baltimore, Md. Filed Nov. 17, 1894.

533,323. System for and Method of Electrical Distribution of Energy. William Stanley, Pittsfield, Mass., assignor to the Stanley Laboratory Company, same place. Filed Nov. 3, 1894.

533,378. System of Electrical Distribution. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company, of New York. Filed Apr. 5, 1894.

533,379. System of Electrical Distribution. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company, of N. Y. Filed Apr. 11, 1894. Renewed Dec. 24, 1894.

533,381. Car-Fender. John Taylor, Troy, N. Y. Filed Oct. 5, 1894.

533,398. Automatic Electric Safety System for Railroads. Rene R. Snowden and Albert C. Ives, Ocala, Fla. Filed Jan. 26, 1894.

ELECTRICAL AGE

VOL. XV., No. 7. NEW YORK, FEBRUARY 16, 1895. WHOLE No. 405

ESTABLISHED 1883.

Entered at New York P. O. as second-class matter, January 18, 1891.

THE ELECTRICAL AGE PUBLISHING CO., PUBLISHER

TERMS OF SUBSCRIPTION:

One Copy, one year,	$3.00
One Copy, six months,	1.50
Great Britain and other Countries,	4.00

Cable Address (all Cables,) "Electage," New York.

W. T. HUNT, President F. N. BASSETT, Vice-President

T. R. TALTAVALL, Secretary and Editor.

NEWTON HARRISON, E. E., Scientific Editor.

ADDRESS ALL COMMUNICATIONS TO

THE ELECTRICAL AGE PUBLISHING COMPANY,

FIRST FLOOR, WORLD BUILDING.

NEW YORK.

NEW YORK, FEBRUARY 16, 1895.

CONTENTS.

PROGRAMME OF THE CLEVELAND CONVENTION.

The following is a copy of the official programme of the meeting of the National Electric Light Association, to be held in Cleveland, O., February 19, 20 and 21:

TUESDAY, FEBRUARY 19, 1895.

Meeting of the Executive Committee at 9 A. M., Parlor 138, Hollenden Hotel.

MORNING SESSION—10:30 O'CLOCK—ARMY AND NAVY HALL.

Address of Welcome by the Mayor of Cleveland.

President Francisco's Address.

Paper by N. W. Perry: "The Storage of Energy Essential to Central Station Economy; How It May be Accomplished and the Economies Resulting."

Discussion. John W. Langley, W. M. Stine, M. J. Perry.

Report of Committee on Relations Between Manufacturing and Central Station Companies. Frederic Nicholls, chairman.

AFTERNOON SESSION—2 O'CLOCK.

Paper by E J. Houston and A. E. Kennelly: "A New Method of Measuring Illumination."

Discussion. W. A. Anthony, C. D. Haskins, W. S. Howell, Edward Weston, L. Stieringer.

Report of Committee on Data. H. M. Swetland, chairman.

Discussion. W. R. Gardener, E. L. Powers, H. W. Sexton.

Paper by Walter E. Harrington: "Correct Method of Protecting Electric Circuits."

Questions and Answers. What Is It You Wish to Know?

Executive Session.

WEDNESDAY, FEBRUARY 20—MORNING SESSION, 10 O'CLOCK.

Paper by Edward Weston: "Some Economies in Electric Light and Power Stations."

Paper by C. N. Black: "Large Arc Dynamos."

Discussion. S. M. Hamill, J. J. Wood, F. W. Rollins, E. R. Weeks.

Topic: How to Light Large Cities.

Discussion. Frederic Nicholls, Geo. A. Redman, Jas. I. Ayer, E. F. Peck, C. R. Huntley, Robert Lindsay, F. H. Clark, T. C. Smith, J. F. Morrison.

Report of Committee on Finance. John A. Seely, chairman.

Questions and Answers. What Is It You Wish to Know?

Executive Session.

AFTERNOON SESSION—2:30 O'CLOCK.

Paper by E. A. Leslie: "The Operation of High Tension Currents Underground from a Physical and Financial Standpoint."

Discussion. H. J. Smith, W. H. Browne, C. H. Wilmerding, John A. Seely, C. L. Edgar.

Paper by L. B. Marks: "Arc Carbons and the Rating of Arc Lamps."

Topic: Incandescent Lighting vs. Other Methods.

Discussion. H. T. Edgar, E. F. Phillips, W. S. Barstow, E. A. Armstrong, J. Gwynn, B. P. Holmes.

Questions and Answers. What Is It You Wish to Know?

Executive Session.

EVENING SESSION—8 O'CLOCK.

Topic. By A J. Wurtz: "Practical Demonstrations of Protecting Lines from Lighting."

THURSDAY, FEBRUARY 21—MORNING SESSION, 10 O'CLOCK.

Paper by Dr. Louis Bell: "The Monocyclic System."

Discussion. A. E. Kennelly, L. B. Stillwell, J. F. Kelly.

Report of Committee on Rules for Safe Wiring. Wm. J. Hammer, chairman.

Topic: Underwriters' Rules vs. National Electric Light Association Rules.

Discussion. Wm. Brophy, C. H. J. Woodbury, J. J. Burleigh, A. W. Field.

AFTERNOON SESSION—2:30 O'CLOCK.

Executive Session.

Report of Secretary and Treasurer.

Executive Committee.

Election of Officers.

THE MECHANICS OF ELECTRO-MAGNETISM

(*Concluded.*)

BY WILBUR M. STINE, D. SC.

Second Paper.

The ether may accept a stress applied upon it and transmit energy to such an extent that the limit of this property cannot be even guessed at with certainty. But in stress relations the ether can in no sense absorb energy and transform it; this is a function of matter alone. The failure to recognize this has led to many false conceptions with regard to permanent magnets.

The attempt was made in the first paper to show the mechanism of the establishment of a magnetic field by a current. Fig. 6 deals with the reciprocal relation, the induction of a current by a magnetic field. It is here designed to illustrate the relation between the direction of rotation of a tube of force and the flow of the current which it induces in a conductor. A rubber-tired wheel moves around in a clockwise direction, bearing firmly on a flexible band which is free to move with a little friction over the support AB. The forward motion of the band is then the true tangential component of the

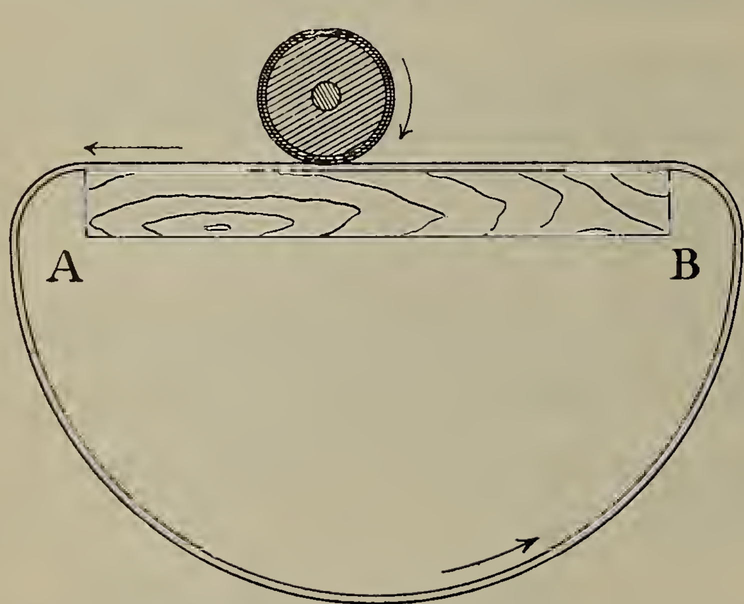


FIG. 6.

wheel's motion at the point of contact. It will be seen that whether the band be pulled and turn the wheel, or the wheel rotates and moves the band forward, the relation of their two motions is always the same.

A conductor has been defined as matter which in a certain sense can absorb electrostatic stress from the ether, but in which this condition of stress cannot be maintained, but is equalized with more or less rapidity. In Fig. 7, A, B, as a conductor has a stress impressed upon it by the whirls E which renders the end A positive and B negative, or an e. m. f. has been impressed upon it, the resulting current flowing from A to B. In the conductor C, D, the relations are reversed, because the rotation of F is opposite to that of E.

The subject has been developed to this extent in order to apply such mechanical analysis to the clearer explanation of certain points in the production of an e. m. f. in the dynamo and transformer. The conditions under which an e. m. f. are impressed upon a conductor and the direction of the current with reference to the motion of the conductor in the field of force are matters which to most persons are purely empirical. It may be stated as a general premise that when a conductor is moved in a magnetic field, in any manner except parallel with the lines of force, an e. m. f. is established whose value depends solely on the time rate of cutting the lines. This statement is independent of such conditions as whether the field is varying in strength or uniform, or whether the conductor forms part of a closed or open circuit In a certain sense the statement is as axiomatic as the second law of motion, that every force produces its effect independent of the action of all other forces. This must not be confused with the resultant or apparent effect. The apparent e. m. f. in any case may be regarded as the resultant e. m. f. in a circuit.

The assertion is made that a closed circuit moving parallel with itself in a uniform field of force generates no current. This is true, but an e. m. f. is impressed upon it. Fig. 8 shows a square conducting closed circuit, A, B, C, D, cutting through a uniform field of force in the direc-

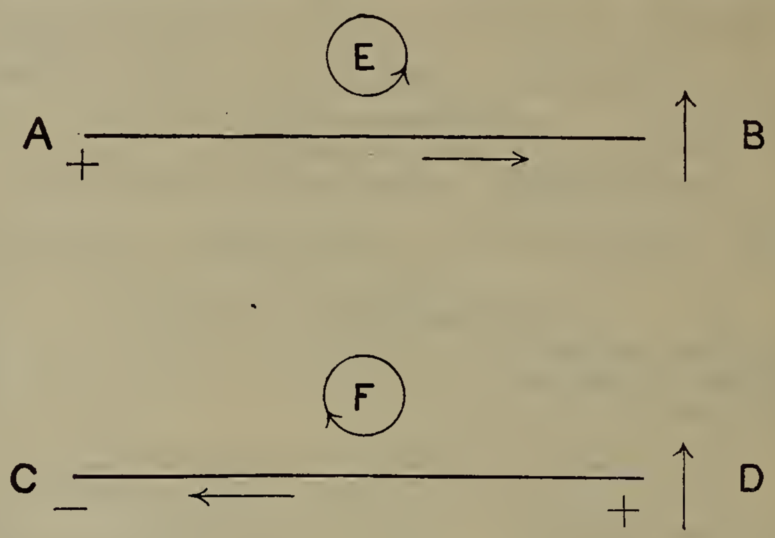


FIG. 7.

tion from C to D. The south aspect of the lines or tubes of force is shown. The section of the circuit B, D, striking the whirls has an e. m. f. impressed upon it of a value of five unit lines cut, the stress being from D to B, A, B, and C, D not cutting the lines of force have no e. m. f. impressed. The section A, C likewise cuts the whirls and has a five-unit e. m. f. impressed whose direction is from C to A If these e. m. f's. be traced around the circuit they will be found to be opposed, and being equal in value the resultant on the circuit is zero, or no current will flow. Should D, B cut six whirls while A, B cuts five, in passing into a stronger field, a current would then flow around the circuit in a counter clockwise sense, under an e. m. f. whose value was one unit.

Aside from the *direction* of the e. m. f. in a conductor cutting lines of force, the *manner* in which this e. m. f. is supposed to be established is of the greatest interest. Let the usual conception of its production in the coil of the armature of a dynamo be considered. That it is due to

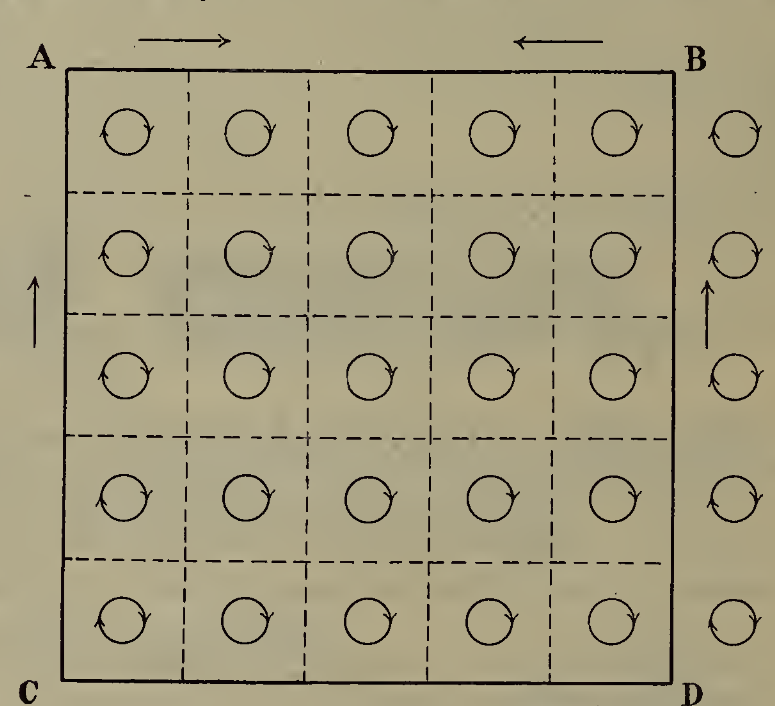


FIG. 8.

the cutting of lines of force has been thoroughly established. The direction of the e. m. f. and that, too, of the consequent current has been experimentally established when the two elements of the direction of the lines of force and the motion of the conductor through the field are known. The simplest rule of "thumb" connecting these elements is due to Fleming, and is so well known that it needs no restatement. In Fig. 9 the sequence of

the three directions at right angles to each other is shown. Let us apply this to an armatnre coil moving through its field. On the supposition that the field of force is composed of mere lines of force, how can the known direction of e. m. f. or current be accounted for? It has been further established that a conductor carries the line cut or

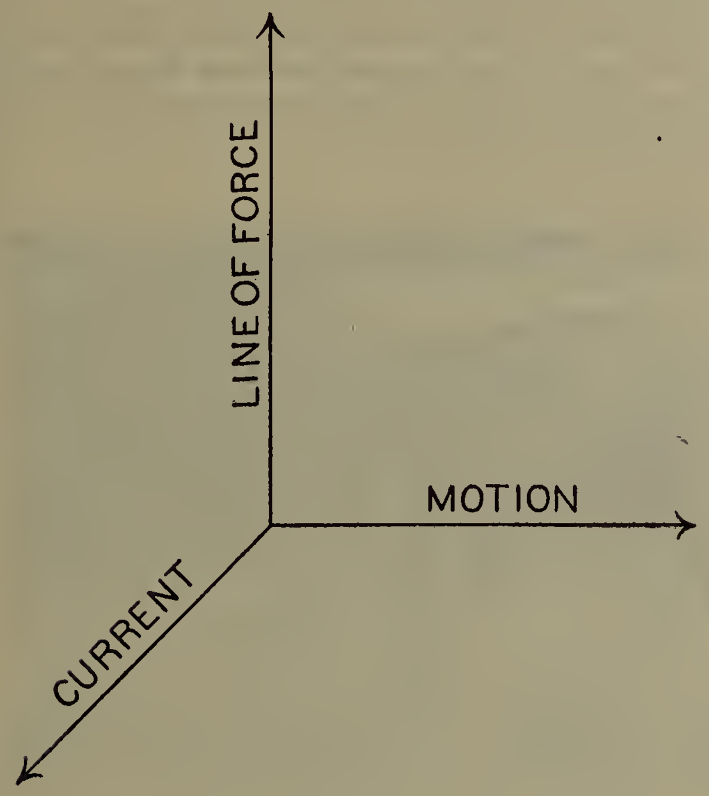


FIG. 9.

struck forward with it to a certain extent as if the line were an elastic string, which after being carried forward a little way would yield and let the conductor "cut" it. The conductor in carrying the line forward is stressed *from* the point of contact. When this stress lets go the e. m. f. or current would take the direction of the arrows shown in Fig. 10, with the result that the currents would be equal and opposed on both sides of the circuit, and hence no final current would be produced. We are thus forced by known facts to suppose that the direction of the e. m. f. or current is due to a true motion in the lines themselves. This motion, as has already been pointed out, is in the nature of a whirl, always of definite direction. In Fig. 11 the arrows indicate the same relative directions of lines of force, motion and current as in Fig. 9. But the line of force is here pictured as a whirl, with a clockwise direction, looking along the positive direction of the line. In

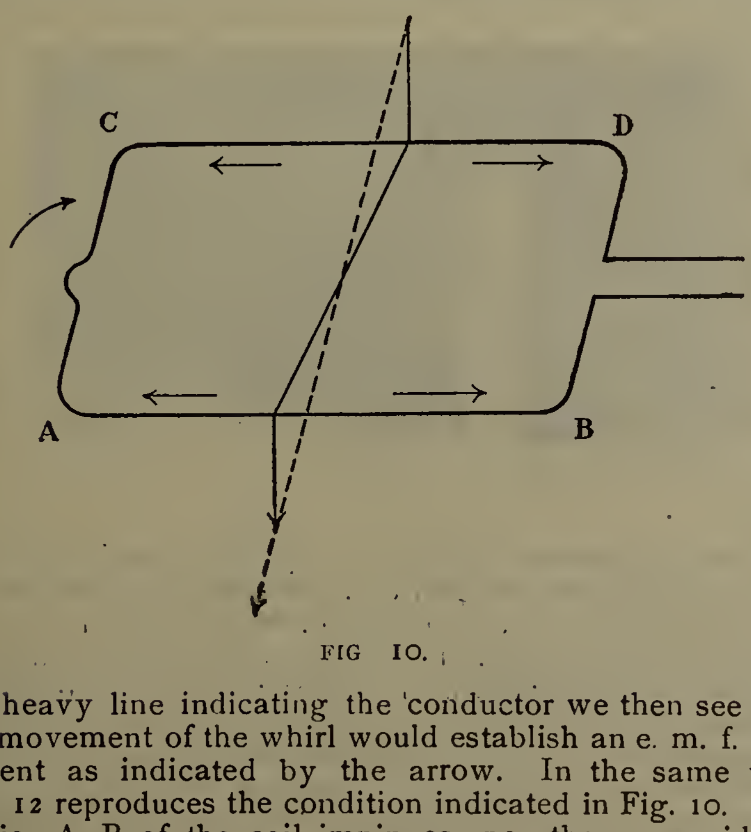


FIG 10.

the heavy line indicating the conductor we then see that the movement of the whirl would establish an e. m. f. or a current as indicated by the arrow. In the same way Fig. 12 reproduces the condition indicated in Fig. 10. The section A, B of the coil impinges upon the upper side of the tube of force and its e. m. f. is from A towards B. The section C, D hitting the under side of the whirl has an e. m. f. from D towards C. The current then flows in an opposite sense in both sections, but is continuous in direction when traced around the circuit, since both e. m. f.'s are added, being in the same direction. We have in Fig. 12 a repetition of the motions depicted in Fig. 7.

If this relation of the tubes of force to the production of an e. m.f. is clearly understood, it furnishes at once a very simple rule for determining the direction of the current in any given dynamo. It furnishes a rule which is superior to the empirical ones in this respect, that it affords at the same time an explanation of the phenomena located. Put in shape the rule would be, determine the direction of the lines of force, or, in other words, the polarity of the dynamo. The motion of the armature shows the side of the whirl which is struck. The e. m. f. or current in the conductor will then be in the same direction as that of the whirl at the point struck. It must be remembered that if the direction of the tubes of force is *from* the observer, he will be looking at their *south* aspect, and the direction of their rotation will be *clockwise*. If the direction of the tubes is *toward* the observer, the conditions will be reversed.

The greatest air of mystery seems to surround the energy relations in such cases. Does the energy of the induced current come from the magnetic tubes cut through, or is the horse-power of the engine expended in moving the conductor through the field? The fact that a

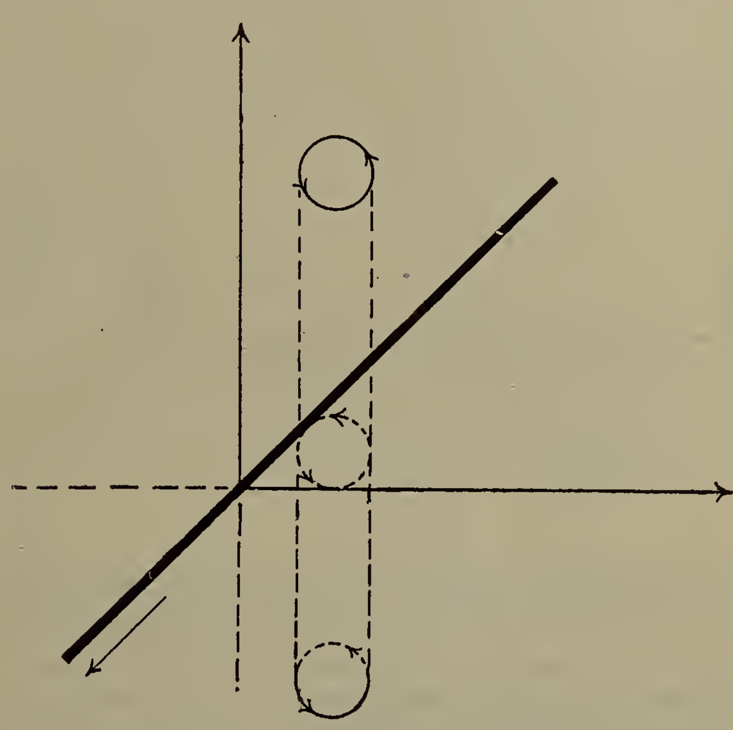


FIG. 11.

current must circulate continuously around the field coils of a dynamo seems to make the confusion worse confounded. Many persons seems to think the magnetic tubes are somehow or other stuffed full of energy and these, when *cut* by the conductors, squirt their energy into them, which reappears as an electrical current.

Let it be remembered that the ether can *transmit* energy to an unlimited extent, but not *transform* the energy of motion into that of current. The energy of the current is not derived from the energy in the tubes of force, but from the energy which moves the conductors through them. Neglecting the armature reaction the lines or tubes of force are not annihilated or absorbed by the movement of the conductor through the field. A conductor must be regarded as if it were a spring which may be extended when dragged through the magnetic field. But the extended spring, when the circuit is closed, immediately relaxes its motion, thus constituting what we call an electrical current. The ohmic resistance in the circuit impedes the relaxing of this spring; the maintenance of the e. m. f. of the dynamo depends upon the extension of this spring by cutting new lines of force as rapidly as its tension is neutralized throughout the circuit. This spring is then wound out by being pushed against the whirling ether tube of magnetic force; and the energy of the current is thus derived from the pushing against the whirl and not from the

tube of force. Were it derived from the tube of force, then a conductor at rest in a magnetic field would have a perpetual e. m. f. established in it. Placing a closed circuit in the field of a permanent magnet would continuously induce in the circuit a current; the whole arrangement would then furnish an inexhaustible source of power.

What then is the function of the exciting current in the field coils of a dynamo? After the field has once been established the function is simply *directive*. Each molecule or atom of the iron of the fields is supposed to have a smoke whirl like that depicted in Fig. 4, connected with it. These whirls in a piece of soft iron are closed about the molecule. At the first rush of current through the field coils the molecular whirls are opened out until they pass through the entire magnetic circuit of the dynamo. Energy is expended in doing this, but the field once established requires no further expenditure of energy, neglecting the armature reaction.

After the field has once been established the energy absorbed by the field coils is represented by the C^2R loss in them, and would be the same whether the coils were on the fields or located in any other portion of the circuit. No energy can be absorbed by any simple *directive* action. After the field has once been established, could the mag-

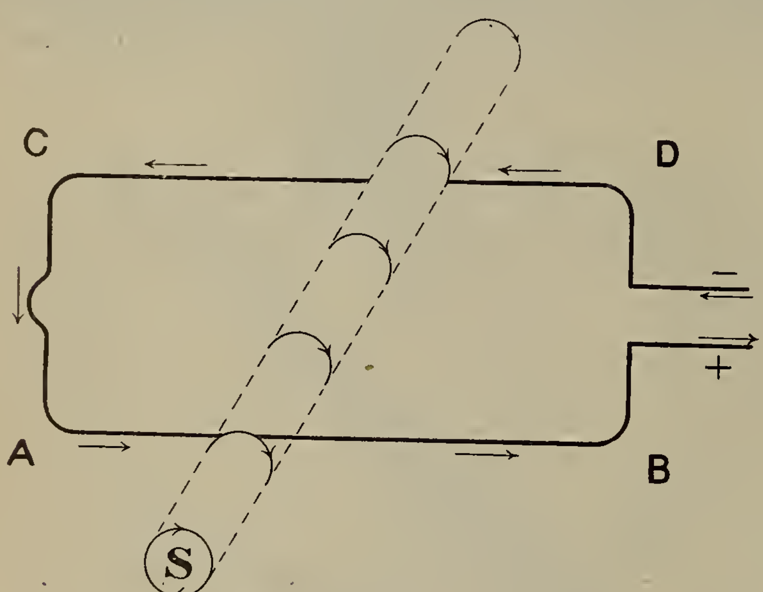


FIG. 12.

netism be made permanent, the current could be dispensed with and the C^2R loss saved. But complexity is introduced by the variation of field strength due to compound winding for purposes of regulation. Yet the energy relations here, though more complex, are the same as noted above. The energy absorbed in establishing the field is restored in the so-called "Extra Current" induced in the coils when the dynamo is stopped.

THE NEW TELEPHONE SYSTEM OF PARIS.*

BY E. HOSPITALIER.

In the majority of the large European and American cities, the subscriber is called up by the number of his apparatus. In France we have still, and have had for a long time unfortunately, the call by proper name, with a telephonic population of from 13,000 to 14,000 subscribers, including one hundred mutations per week, a somewhat floating personnel, voluminous indices that are kept open with difficulty, etc. It will be seen that the researches in the index lead to loss of time or to errors, especially when one asks for Mr. Durand or Mr. Levy without specifying the title of the subscriber with the too common proper name in question. The calling up to the office by the subscriber and of the subscriber by the office is effected by a battery, while in other countries magnetic calls that lead to more simple arrangements are employed. From another point of view, the use of exclusively subterranean telephone lines, generally placed in the sewer, increases the expenses of installation in a certain measure and complicates the surveillance and the search for defects. We speak of the double line only as a reminder, for, sooner or later, the development of the electric industry will oblige all the urban lines to adopt what is known as the double wire system, and from this point of view at least the Societe Generale des Telephones has, from the outset, given a good example by establishing all its lines according to this system.

After these general considerations, let us return to the telephone system of the city of Paris, a simple and rapid expose of the successive transformations of which may present a certain interest.

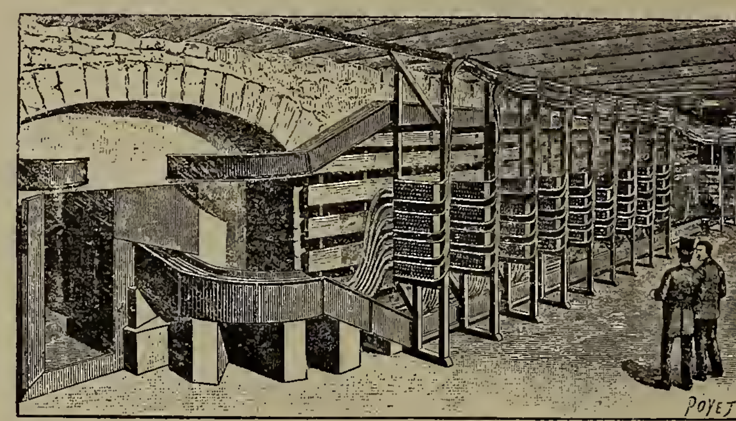


FIG. 1.

From July to September, 1879, scarcely three years after the discovery of the telephone, three companies asked for and obtained concessions for the organization of telephone lines exploited according to three rudimentary systems, but sufficiently different to render the putting of the three lines in communication impossible. Soon afterward, a fusion occurred, whence arose on the 10th of December, 1880, the Societe Generale des Telephones, which, at the beginning of 1881, had 300 subscribers. A few figures will permit of forming an idea of the truly extraordinary development undergone by the telephone system since that epoch, and especially since the somewhat unfeeling acquisition of the service by the state in September, 1889.

At the end of 1880 the Societe Generale des Telephones had but 300 subscribers; at the end of 1881 the number had increased to 1,602, at the end of 1882 to 2,692, at the end of 1884 to 3,700, at the end of 1885 to 4,054, and at the end of 1889, shortly after the acquisition by the state, there were at Paris 8,306 subscribers, and, at the end of 1891, 9,635; while the figure that it will be necessary to put down for the beginning of 1895 will be 14,000, if it does not even exceed this figure.

FIG 2.

At the acquisition of the lines by the state the tax was reduced from $120 to $80, and this reduction led to so rapid an increase of the number of subscribers that it became necessary to entirely modify the processes and the communicating apparatus in order to respond to the requirements, which, it must be admitted, exceeded the resources of the art and which had not as yet manifested themselves so rapidly in any other city in the world, even in America, where, nevertheless, telephony had birth, but where higher tariffs, with good reason, curtailed the number of subscribers.

In 1889, at the time of the forced cession of its system

* *La Nature*, Paris.

of lines, the Societe Generale des Telephones, which had about 6,000 subscribers in Paris, was exploiting this system by the aid of twelve district offices connected by auxiliary lines. Its principal advantage was that of reducing the mean length of the subscribers' lines in a great measure, but it offered the great defect of giving the largest number of communications in passing through two district offices, the direct putting in communication being so much the rarer in proportion as the offices were more numerous and as each of them served a smaller number of subscribers. The number of subscribers and the length of the line, on another hand, prevent the connecting of all the subscribers of a large city with a single central office.

A selection has therefore been made of a mixed combination, and, in the general plan of the new system, the district offices have been reduced to four only: (1) An

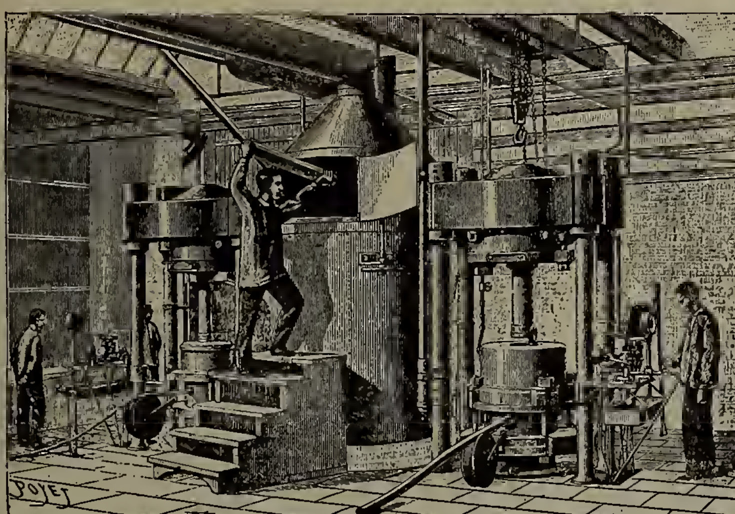


FIG. 3.

office on Gutenberg street, near the Halles, for the 6,000 subscribers of the centre, and the one that we shall more especially describe; (2) an office on Wagram avenue, for 3,000 subscribers, which has been in operation for more than a year and does service for Auteuil, Passy and the Batignoles; (3) an office on Belleville street for 6,000 subscribers, for Menilmontant, La Villette, Belleville, etc.; and (4) a single office for the entire left bank, as yet in contemplation.

These four offices will be able to do duty for about 20,000 subscribers, plus the auxiliary, interurban, international and accessory lines that are ingrafted upon them. The number of subscribers at present is more than 13,000. The prophetic figure of 20,000 will probably be reached even before the four constructed or projected offices are completely finished. It will then be necessary (sad perspective!) to rearrange the line and to once again modify the system, which has already ceased to meet its object exactly and is no longer abreast of the new progresses of telephonic technics. The Parisian system is the tapestry of Penelope of our telephone engineers. The continuously renewed difficulties of the task that they have undertaken ought to render us particularly indulgent toward a service that is indisputably imperfect, but which, by its nature, could not even reach mediocrity in imperfection.

One will be able to obtain an idea of the complication of the system, of the precautions to be taken and of the difficulties to be overcome from a simple enumeration of the connections necessary to bring a subscriber's station to the board, and of the arrangements to be made in order that an accident (and the causes of accidents are numerous upon lines exclusively subterranean) may be quickly localized and repaired without the introduction of any trouble into the service of the other subscribers.

In order to simplify the explanation, we shall consider only the connections relative to an ordinary subscriber situated in the radius of the central office that does service for him. The double line of lead-covered wires insulated with gutta-percha starting from the apparatus of a subscriber enters the sewer, where it meets other double lines with which it runs parallel as far as to a coupling box, which serves to connect seven subscribers with a 14-wire lead-covered cable insulated with paper. The first grouping is therefore made by sevens. Seven similar cables corresponding to 49 subscribers end at a cutting chamber, whence starts a 104-conductor cable (52 lines). This chamber permits of making connections between the 49 subscribers and the 49 double lines. The three last double lines form a valuable reserve in case of accident to a wire of the 104-conductor cable.

These 104-conductor cables enter the central office directly.

The length of the two-wire cables connecting each subscriber with a coupling box is quite feeble. The mean length of the seven-subscriber cables (14 wires) at Paris is 1.2 mile, but it reaches as many as 3.5 miles for the most distant subscribers. The mean length of the forty-nine-subscriber cables (104 wires) is 5,250 feet, with a maximum of 2.4 miles.

The linear insulation required for the 104-cable conductors between each wire and the covering is at least 200 megohms to the mile, but, in practice, it reaches a much higher value, say from 10 to 30 times greater. Thanks to the construction of the cable, it is possible to blow into it air dried over chloride of calcium, which improves the insulation.

At A, in Fig. 4, is seen a transverse section of a 104-conductor cable covered with its $\frac{1}{10}$ inch thick leaden tube.

Before going farther, it will be of interest to point out the reasons that have caused the substitution of the new cables insulated with paper for the old lead-covered cables of the Societe Generale des Telephones.

The old cables insulated with gutta-percha were formed of fourteen wires inclosed in a leaden sheath, whose external diameter was $\frac{8}{10}$ of an inch; the linear weight, four pounds to the mile; the linear resistance of each wire, 62 ohms to the mile; the linear insulation, from 400 to 5,000 megohms to the mile; and the linear capacity, 0.5 microfarad to the mile.

These cables presented several drawbacks. They were costly and had a great linear resistance, and especially a great electrostatic capacity. Moreover, they took up so much space in the sewer that they soon became cumbersome in the vicinity of the central offices, especially when the reduction in the number of such offices necessitated the introduction into each of them of a larger number of cables.

The present main cables are of the Patterson system, insulated with paper and without paraffine. Each conductor is formed of a copper wire 0.04 inch in diameter.

FIG. 4.

surrounded with two bands of paper, the first of which is wound with a very long pitch in order to facilitate the passage of the air, and the second with a shorter pitch in order to maintain the first, which forms around the wire a sheath in which the air circulates freely. Two conductors are twisted with a pitch of eight inches and then corded in regular layers wound in opposite directions, so as to form a very regular cylinder. The 104 wires (52 pairs) are afterward covered with a lead tube, of which the thickness is about 1.4 inch and the external diameter but two inches.

The similar cable has a linear resistance of no more than 40 ohms per mile and 0.12 microfarad per mile of linear capacity (per wire), while its linear insulation reaches

6,000 megohms per mile, and may reach 12,000 and even 16,000 through the passage of a current of dry air.

The putting of these cables under lead merits special mention. The strand of the 52 pairs once finished is placed in a stove, where it is dried before reaching the lead presses. These latter, which are represented in Fig. 3, consist of a hydraulic press whose piston exerts its pressure upon a piston that moves in a cylinder which is periodically filled with lead that has been melted in a furnace, such as is represented in Fig. 3, between the two presses for which it does duty. The molten lead introduced into the cylinder of the press is kept at a proper temperature by a row of gas burners which surround the cylinder. The cable is introduced through the back of the press into an ajutage of appropriate form and makes its exit through the front of the press. Through the play of the pressure alone the lead is introduced into the ajutage, becomes moulded around the cable and pushes it forward. The temperature of the lead is such that the paper is in nowise carbonized, and that on its exit from the press the lead covering is solidified.

Let us now return to the system of cables and wires of the central office. A central office for 6,000 subscribers thus receives 12,000 utilized wires and from 120 to 130 cables, without counting the auxiliary lines, designed to connect the various central offices with each other. The entrance of these cables at the office into large iron plate boxes, designed to support them and especially to protect them against the gnawing of rats, is seen to the left in Fig. 1. Each cable ends in a coupling box, a sort of cast-iron case, the details of which are seen at B and C, Fig. 4. The 104-wire cable is introduced through one of the extremities of the box, and the wires, separated from each other, are attached to 104 terminals mounted upon the anterior wall of insulating material (Fig. 4, C). The terminals traverse the insulating partition and project from the front part (Fig. 4, B).

To these terminals are attached 104 wires forming two cables of 52 wires each, and thus capable of doing service for 25 subscribers, the twenty-sixth conductor forming a reserve.

These wires leave the coupling boxes, as may be seen, for a part of the line (Fig. 1) and reach the distributer represented in Fig. 2. The distributer is an immense junction frame, the object of which is to permit of a direct putting in communication, without any other wire being touched, of any one of the 6,000 double conductors with any one of the 6,000 numbers of the office.

The object of this arrangement is easy to understand. The subscriber preserves the first number given him indefinitely, even when he changes his address, provided his new quarters be within the perimeter served by the same central office. This number corresponds to that of the board and is not changed on the latter except in case of accident thereto. But we have seen that between the subscriber and the office there are interposed multiple junctions that permit of replacing any one of the sections of a line that has become deteriorated, and, particularly, of utilizing the spare lines of the 104-conductor cables. The object of the distributer is to permit of such changes of cables without a change of the subscription number or of a communication with the corresponding number of the central board.

To this effect, all the 52-conductor cables starting from the cable ends reach the upper part and the rear of the distributer (Fig. 4), and end at terminals mounted upon large uprights arranged upon the posterior face of the distributer. The double wires coming from the communicating board from cables of 42 wires, 40 of which do duty for 20 subscribers, the twenty-first forming a spare conductor. These wires are connected in front of the board with terminals arranged upon horizontal bars methodically numbered by groups and by units.

The connection between any one of the cables and any one of the wires coming from the office is effected very simply by connecting the two pairs of terminals of a vertical bar (line) and of a horizontal bar (office) through a double wire. The inextricable confusion that would be produced by such puttings in communication and the frequent mutations that they necessitate is avoided through horizontal frames upon which the wires rest in running from the front to the back of the board before ascending, descending and turning to the right or left in order to connect the conductor of the board with the conductor of the corresponding line. When a communication is suppressed the double connecting wire likewise is suppressed, and this renders both the number of the board and the corresponding cable free.

Finally, the following are, as a whole, the connections interposed between the subscriber's instrument and the central board: coupling box (from 7 to 50), end of cable (from 50 to 25), distributer (from 25 to 20). The 20 double conductors finally reach the telephone or multiple boards.

HEADQUARTERS AND FACTORY OF THE NEW YORK ELECTRIC EQUIPMENT CO.

LARGER QUARTERS.

The New York Electric Equipment Company, which has for the past three years conducted its business at the corner of Duane and Elm streets, New York, has removed its offices to its factory building, at Nos. 572 to 578 First avenue, corner 33rd street.

This change was rendered necessary to accommodate the rapidly increasing business of the company, the old quarters being inadequate for its proper transaction. The old establishment, however, will be continued as a branch salesroom for the convenience of near-by customers, and as a branch supply depot for other contractors.

The effect of this move is to bring the executive, selling, constructing and manufacturing departments under one roof, which concentration of forces will enable the company to fill its orders with greater celerity.

The New York Electric Equipment Company makes bulk contracts for everything required for electric light, heat and power, and is the agent of the Edison Electric Illuminating Company, of New York, for Edison patented supplies.

The company succeeded to the business of the construction, wiring and supply departments of the Edison Electric Illuminating Company, of New York, nearly three years ago, and its success is well-known. It has built up an excellent reputation for promptness in filling and careful attention to orders, and its work is first-class in every particular.

The accompanying illustration gives a view of the company's new headquarters. They are commodious and especially equipped with all the necessary tools and machinery, etc., for so large an industry.

MONARCH CYCLES AND ELECTRIC LIGHTING.

One of the most attractive and extensive exhibits at the recent Cycle Show at Madison Square Garden, New York, was that of the Monarch Cycle Company. We give herewith an illustration of this notable exhibit. The electrical features were very fine and beautifully arranged. The sign at the back of the enclosure contained nearly 500 small incandescent lamps, which, when lighted at night made a very attractive display. The lions' heads at the ends of the sign were surrounded by a circle of lamps, and the figures of the "Monarchs of the Jungles," flanking the entrance, had electric lights placed in the eye sockets which gave a sparkling effect. The tongues of the "Monarchs" were rendered a brilliant red by the same means, and altogether the effect was decidedly unique.

The two large frames below the sign each contained a "Monarch" cycle, with the wheels kept in motion by a small electric motor. The rim of each wheel, pedals and chain guards were decorated with vari-colored incandescent lamps, and as they revolved the effect was very pretty.

The "Monarch" exhibit was besieged with visitors, proving that the wheel is a very popular one.

The New York managers are the C. F. Guyon Company, Ltd., 97 and 99 Reade street, New York. Both Mr. Guyon and Mr. L. F. Schnitzpahn were kept very busy answering the many inquiries directed at them, and they ascribe much of their success on this occasion to their attractive electrical display.

EXHIBIT OF THE MONARCH CYCLE CO. AT THE CYCLE SHOW, MADISON SQUARE GARDEN.

DEATH OF COL. HINCHMAN.

Col. J. Augustus Hinchman, of the Bureau of Information of the Metropolitan Telephone Company, 18 Cortlandt street, City, died suddenly on February 8, at his hotel, the Vancourt Inn, Roselle, N. J. The cause of his death was apoplexy, with which he was stricken as he was leaving his hotel to come to the city. He had been connected with the telephone company for the past seven years, and prior to that time had been in the service of the Western Union Telegraph Company. He was a brother of Mr. J. C. Hinchman, superintendent of the Western Union Building.

Mr. Hinchman was very popular with all of the officers and employés of the telephone company and highly esteemed by all his acquaintances. He was an Argonauter of '49, during the California fever. He was at one time connected with the Post-Office under Col. Thos. L. James and had charge of the records of the office. He was a contributor to the columns of several of the daily papers in New York.

ELECTROLYSIS OF PIPES IN BROOKLYN.

The Board of Commissioners of Electrical Subways, Brooklyn, N. Y., have just issued their report for 1894. It shows the aggregate length of electrical conductors of all kinds within the city limits to be 16,772.428 miles. Of this 9,380.406 are underground and under the elevated roads. The total length of the aerial wires is 6,447.532 miles. During the year 2,005.43 miles of wire were buried and suspended under the elevated roads.

Referring to the electrolytic corrosion of underground wires the report says that fully 400 miles of telephone wire have, from various causes, been rendered worthless. During the past year 300 miles have been rendered useless by the corrosion of the lead covering of the cables.

Illustrations are given showing the effect of electrolytic action on pipes, the examples being cut out as evidence of the damage done. Iron, copper and lead are all represented. A copper drip-pipe had an outside diameter of one inch and in 17 days it was reduced to a mere shell and

punctured in several places. "The facts thus recited and illustrated," the report concludes, "serve to continue the record of last year's report, and to emphasize the conclusions regarding possible undetected injuryto the water pipes belonging to the city."

George W. Plympton and Fred. R. Lee are the commissioners.

The report of City Electrician John A. Barrett, dwells entirely on the subject of electrolysis of pipes by trolley currents. The conditions in Brooklyn, he says, are similar to what are reported from other large cities.

Regarding the subject of corrective measures, Mr. Barrett says:

"The first thing to be done is, so far as practicable, to keep the railroad electricity off the pipes in all those regions where there is a tendency of the current to overflow from the rails to the pipes. The one method by which this overflow may effectually be diminished is to provide a more liberal system of return conductors than at present prevails, at least on some portions of the Brooklyn railroads. The limit to which the perfection of the return system should be pushed ought to be fixed by considerations of reasonable cost.

"After everything that is reasonable has been done in this direction, there will still be a large overflow of current from the rails which will be collected by the pipes and will be conveyed along the pipes to points where the conditions favor its discharge again into the earth.

"The second thing to be done is to locate, by careful investigation, the points where this large and unavoidable residue of earth current tends to leave the pipes; and, by a system of special return wires directly connected at brief intervals to the pipe mains, to draw off as much as possible of the accumulated electricity harmlessly from the pipes, and thus to obviate the electrolytic action which is sure to accompany the passage of the current directly from the surfaces of the pipes into the earth.

"These two methods of treatment have frequently been proposed:

"It is important to associate the two steps in their proper relations with each other. In general, the attachment of the lead wires to the pipes in the danger districts should not be undertaken until an adequate system of outlying returns has been provided by the railroad companies, After all that is practical has been done to convey back the railroad current to the power stations by proper return conductors, then the pipes in the vicinity of power stations may be relieved of the unavoidable overflow by lead wires correctly applied. Under these conditions the railroad companies will be prevented from relying upon the underground pipes, particularly the water pipes, as a material and proper part of their return systems, and the pipes, so far as regards the principal circulation of trolley currents, would virtually be safe.

"The exceptional location of danger spots, due to causes which have been mentioned, and to other more obscure causes, and especially to the relations between gas and water pipes, will remain to be hunted out, and a remedy applied to each specific instance. Such an investigation would include a study of the relations between the systems of independent railroads and the effect of earth plates. The remedies, after adequate and properly related systems of returns have been provided, would consist chiefly in electrically uniting different lines of pipes at suitable points, in establishing metallic connections between pipes and rails at places indicated by the conditions, and, in general, in drawing the electrical charge off from the pipes by the direct attachment of negative feed wires wherever a dangerous accumulation is found."

THE ELECTRICAL SPECIAL FOR CLEVELAND.

The following is a list of the names of those who have so far engaged seats on the Electrical Special, which leaves New York at 9:30 A. M., Monday, February 18, via New York Central:

Jas. P. McQuaide, P. L. McLaron, John A. Seely, C. O. Baker, Jr., Mrs. C. O. Baker, Jr., A. J. Belden, Mrs. A. J. Belden, F. W. Harrington, S. L. Coles, H. J. Smith, Mrs H. J. Smith, M. J. Francisco, Mrs. M. J. Francisco, I. H Francisco, Don Francisco, C. H. McIntire, Mrs. C. H. McIntire, E. F. Peck, Mrs. E. F. Peck, F. S. De Ronde, Mrs. F. S. De Ronde, A. J. Purinton, W. J. Johnston, Mrs. W. J. Johnston, Cecil P. Poole, R. O. Heinrich, Edward Weston, Chas. D. Shain, E. W. Little, A. E. Bakewell, E. H. Johnston, T. C. Martin, Geo. M. Phelps, A. J. Martin, F. A. Scheffler, Mrs. F. A. Scheffler, Jos. Sachs, T. R. Taltavall, W. T. Hunt.

ON A PROPOSED MODIFICATION OF THE GENERALLY ACCEPTED TEMPERATURE COEFFICIENT OF RESISTANCE FOR COPPER WIRES.

BY A. E. KENNELLY AND REGINALD A. FESSENDEN.

In a paper entitled "Some Measurements of the Temperature Variation in the Electrical Resistance of a Sample of Copper" read at the International Electrical Congress at Chicago, 1893, and also published in the *Physical Review* (Vol I, No. 4, page 260,) the authors showed that the temperature coefficient of resistance at any temperature ($t°$ centigrade) of a sample of good commercial copper wire, which appeared by chemical analysis to have a high degree of purity, could be very closely represented by the formula,

$$Pt = Po\ (1 + 0.004065\ t) \qquad (1)$$

Recent determinations by Messrs. Dewar and Fleming and Messrs. Swan and Rhodin concur in giving a linear relation between temperature and resistance.

As the results of measurements made to determine the temperature coefficient in annealed copper wire, we have for the range from 0° to 100° C, assuming a linear relation, as follows:

Benoit	.373
Cailletet and Bouty	.425
Mattheissen	.422
Siemens	.388
Dewar and Fleming	.424
Kennelly and Fessenden	.406
Swan and Rhodin	.415
We obtain as the mean	.4076

We therefore suggest that since the exact temperature coefficient is not yet determined, and since it may possibly vary in different samples of copper in commercial use, that the simple formula,

$$Pt = Po\ (1 + 0.004\ t) \qquad (2)$$

may be accepted provisionally for all practical purposes, or, in other words, that the resistivity of copper be considered to increase by 0.4 per cent. per degree centigrade of temperature elevation reckoned from the resistivity at zero centigrade.

Should the corrected coefficient be subsequently determined to be 0.0041, formula (2) would become,

$$Pt = P_6\ [1 + 0.004\ (t-6)] \qquad (3)$$

P_6, being the resistivity at 6° C.

Similarly, if the co-efficient subsequently accepted should be 0.0042, the corresponding formula would be,

$$Pt = P_{12}\ [1 + 0{,}004\ (t-12)] \qquad (4)$$

P_{12} being the resistivity at 12° C, and for an accepted coefficient of 0.0043,

$$Pt = P_{17.5}\ [1 + 0.004\ (t-17.5)] \qquad (5)$$

Consequently, if we adopt equation (2), at the present time we obtain, pending more exhaustive enquiry, a formula much simpler, more convenient, and probably more nearly accurate than that of Matthiessen, while any future correction can only have, it would seem, an influence upon the standard or datum temperature, and a comparatively trivial quantitative effect within ordinary temperature ranges.

PRINCIPLES OF DYNAMO DESIGN.

BY

Newton Harrison, E.E.

(*Continued from Page 65.*)

When two pieces of steel are subjected to the same magnetizing force—one having been previously magnetized—the number of lines of force produced by the one will be much in excess of the magnetic output of the other. The reason for such a phenomenon is traced directly to the different values of the coercive force possessed by different grades of iron and steel and also to the previous magnetic history of the piece thus experimented upon. A great many interesting tests of iron and steel have been made for the purpose of thoroughly investigating this remarkable effect, with the result of having arrived at certain definite conclusions respecting this interesting condition.

Were the molecules of iron or steel so elastically situated that the application of a magnetizing force producing a certain magnetic flux in a neutral piece of metal, also capable upon its withdrawal of exactly restoring the iron to its original state without the addition of any negative force, the subject about to be treated would possess no weight or scientific interest. But by observation it can be noted that the mere removal of an applied magnetic force will not effect a condition of neutrality unless a reverse magneto-motive force be applied. The amount of energy consumed by such a process of magnetization and demagnetization therefore forces itself upon the attention of practical men, because losses otherwise unaccounted for may be evaluated by an examination of the iron while undergoing this cyclic process. The nature of all metals is so different that we would be led to expect differences in even a class of metals of similar characteristics. Iron, therefore, and its related products must be looked upon in common with all other metals as having a grade of values for this particular but natural property—coercive force.

If a constant magnetizing force be applied to a neutral piece of metal a sudden condition of magnetization is immediately reached; if the piece, after a short interval has elapsed, be again examined it will be seen that the magnetization has increased from its former condition to a greater intensity, as though there had been a gradual increase. Ewing, whose investigations in this direction were of deep interest to the scientific world, called this phenomenon *Viscous Hysteresis*. The ordinary losses sustained by iron while undergoing a complete magnetization and demagnetization are said to be due to *Hysteresis*.

A piece of iron which has been magnetized and from which the magnetizing influence has been removed will still possess quite considerable residual magnetism, so that if the same magnetic force be again applied, the maximum of lines of force then reached will be higher than before. If, instead of producing a greater magnetic flux we take advantage of this condition and only apply sufficient magnetizing force to reach the same condition as before, less energy will be used to produce this same number of lines of force and we are apparently the gainers by the operation.

But withdraw the magnetic influence and a strong residual field still remains, which defies our efforts to remove it by this means. If, however, a reverse current be sent into the coil exercising the magnetic effect, the current can be so regulated that at a certain known strength the iron will become neutral. This operation can be still further continued; the iron can not only be demagnetized completely but can be made to pass this point and produce lines of force in the opposite direction. If this reverse process is carried on to such an extent as to create as great a field in the opposite as in the primary direction, then the demagnetization can be made to occur from this point forward to the other maximum or again to complete demagnetization. The loss experienced by a piece of iron or steel while being subjected to these changes from a positive to negative magnetic maximum and back is wholly due to the fact that perfect molecular elasticity is wanting, and the additional force required to overcome it is fully experienced when a reversed magnetization is taking place.

The energy thus consumed is generally measured in watts per cubic centimeter. As the laws of nature require energy thus absorbed to appear in some perceivable form, we would be led from the nature of the case to look forward to a heating of the iron to an extent comparable to the number of watts wasted while producing the magnetic changes.

A complete change from either a point of perfect neutrality to a magnetic maximum, back again to a negative and equal magnetization and then again forward to the previous condition, is called a *Cycle of Magnetization*. We can start from any point at all in the process and by returning to it by means above described so as to thoroughly complete the entire change, the number of watts consumed for the same sample will always be a fixed quantity.

The heat developed in the iron by these continual reversals would be dependent upon the number of the same occurring in a second of time, while the amount of heat produced by each cyclic change would be dependent upon the extent of the change, or, in other words, upon the degree of magnetization. The iron core of an armature revolving in a magnetic field passes through changes very similar to those just described, absorbing energy at each revolution and evolving heat.

All alternating current apparatus containing iron experiences these conditions; and in all cases due allowance must be made not only for the number of such changes but the specific change per cycle, in order that a correct estimate of the loss may be reasonably made.

The coercive force in a sample of iron or steel changes with every variation in the number of lines of force.

A piece of iron or steel may have a very high primary value for its coercive force, which value will gradually increase as the magnetization increases; while a very good sample of high permeability and small coercive force may under high magnetizations exhibit all the effects of the first sample spoken of.

With $B = 3{,}700$ Ewing found in a soft iron piece that the coercive force was 1.1; and 1.7 when $B = 14{,}000$.

With a harder grade of iron it would be right to expect that the coercive force would be greater, and with very fine qualities of hardened steel to meet it at its maximum values.

Steinmetz, in his investigations found that the coercive force of cast iron was 10 when $B = 6{,}100$ and 15 when $B = 10{,}000$. He also found the value of the coercive force for soft machine steel to be 9 with $B = 14{,}000$ and 11 when $B = 18{,}800$ per square cm.

A table can be drawn up giving the respective values of the loss per cubic centimeter and per cubic inch for iron and steel at different rates of reversals per second and different magnetic fluxes per square centimeter or inch.

The formula Steinmetz advocates for the value of the energy lost per cubic centimeter of iron is

$$U = \upsilon\ V B^{\frac{8}{5}}$$

U = watts lost per cycle per cubic cm. of iron.
V = number of cycles per minute.
υ = constant of iron

The value of μ has been investigated by him for sheet iron and found to be 40×10^{13} and for other samples of iron and steel to be from 33×10^{-13} to 14×10^{11}.

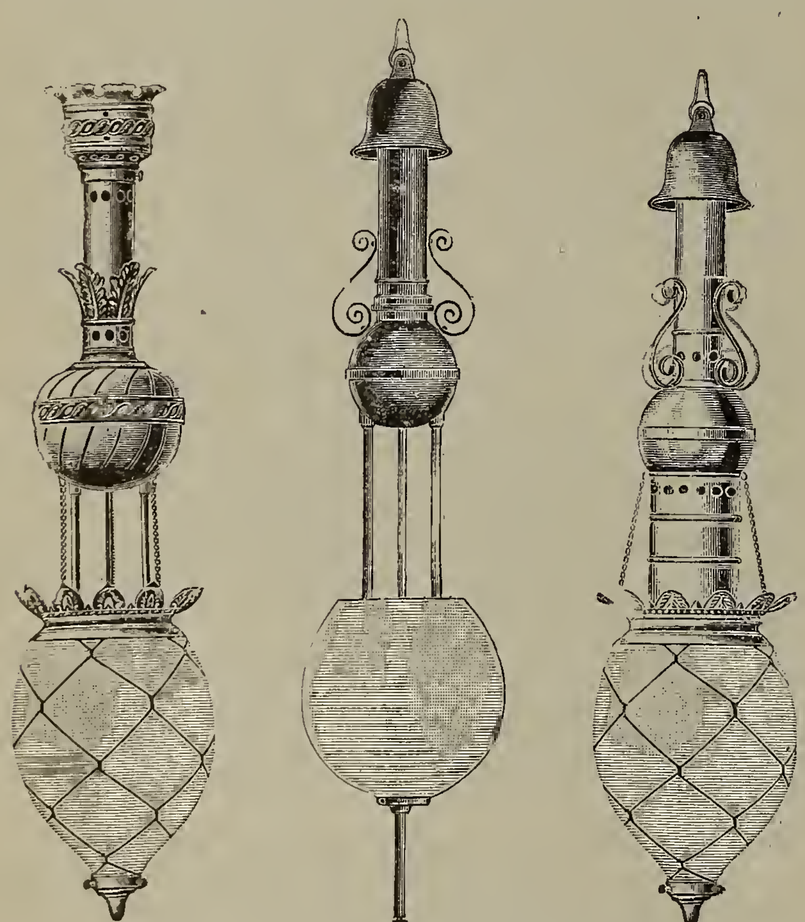
If, upon testing the formula, the value of B is doubled the corresponding value of U will be tripled. Therefore it is evident that, with twice the induction, we have three times the hysteresis.

(*To be continued.*)

SOLAR ARC LAMP.

The Solar arc lamp which was recently put upon the market is meeting with a considerable degree of favor. Its many novel features entitle it to special consideration, and for a serviceable lamp it is unsurpassed. This lamp is designed for low potential circuits, both railway and incandescent, and is very simple in construction. The adjustment of the lamp differs from that of all other lamps on the market. It is accomplished by means of a screw which passes through a slot containing a set-screw. The adjustment being complete, the set-screw is tightened, which prevents the loosening of the adjustment. The mechanism is composed of one set of gears and one magnet, and there are no springs nor dashpot to get out of order and cause trouble. The carbon rod is fed by gravity. The carbon holder is one of the features of the lamp. It has a ball joint which admits of moving the carbon in any direction, and it can be made of any size, to suit the thickness of the carbon pencil.

The Solar arc lamps are designed to run two in series on circuits from 95 to 125 volts. One very strong point of these lamps is that they must burn alike. It is impossible for one to rob from the other. The carbon can be raised or lowered while the lamps are burning, and so long as the arc is not broken, the other lamp is not in any



ORNAMENTAL AND PLAIN SOLAR ARC LAMPS.

way affected, even in the feeding. A brake or friction wheel is used to arrest the motion of the carbons.

The short plain Solar lamp gives from 300 to 500 candle-power on a current of from three to five amperes. It is furnished with a spark arrester for use in factories and other like places where there is any danger from flying sparks.

The Standard and short ornamental lamps are made in all candle-powers, and are designed for commercial and street lighting. Besides these, the Solar Arc Lamp Company manufactures a large line of ornamental lamps of beautiful design for artistic interior lighting.

The Solar arc lamps are made to burn from 6 to 15 hours, the candle-power varying all the way from 300 to 2,000, and taking current of from 4 to 10 amperes. Special lamps are made to order.

The Solar Arc Lamp Company has offices in the Stewart Building, Broadway and Chambers street, New York. They have just completed extensive works at 351–353 Jay street, Brooklyn, N. Y., having lately finished and installed a full line of dies, gigs and special machinery for producing their various styles of arc lamps in large numbers, and are now prepared to take orders for any quantity of lamps of any voltage. The officers of this company are gentlemen prominent in the commercial and financial world.

ELECTRICAL STANDARDS.

(*Concluded from Page 70.*)

SPECIFICATION B.

ON THE PREPARATION OF THE CLARK CELL.

Definition of the Cell.

The cell consists of zinc or an amalgam of zinc with mercury and of mercury in a neutral saturated solution of zinc sulphate and mercurous sulphate in water, prepared with mercurous sulphate in excess.

Preparation of the Materials.

1. *The Mercury.*—To secure purity it should be first treated with acid in the usual manner, and subsequently distilled *in vacuo.*

2. *The Zinc.*—Take a portion of a rod of pure redistilled zinc, solder to one end a piece of copper wire, clean the whole with glass-paper or a steel burnisher, carefully removing any loose pieces of the zinc. Just before making-up the cell dip the zinc into dilute sulphuric acid, wash with distilled water, and dry with a clean cloth or filter paper.

3. *The Mercurous Sulphate.*—Take mercurous sulphate, purchased as pure, mix with it a small quantity of pure mercury, and wash the whole thoroughly with cold distilled water by agitation in a bottle; drain off the water, and repeat the process at least twice. After the last washing, drain off as much of the water as possible.

4. *The Zinc Sulphate Solution.*—Prepare a neutral saturated solution of pure ("pure recrystallized") zinc sulphate by mixing in a flask distilled water with nearly twice its weight of crystals of pure zinc sulphate, and adding zinc oxide in the proportion of about two per cent. by weight of the zinc sulphate crystals to neutralize any free acid. The crystals should be dissolved with the aid of gentle heat, but the temperature to which the solution is raised should not exceed 30 deg. C. Mercurous sulphate, treated as described in 3. should be added in the proportion of about 12 per cent. by weight of the zinc sulphate crystals to neutralize any free zinc oxide remaining, and the solution filtered, while still warm, into a stock bottle. Crystals should form as it cools.

5. *The Mercurous Sulphate and Zinc Sulphate Paste.*—Mix the washed mercurous sulphate with the zinc sulphate solution, adding sufficient crystals of zinc sulphate from the stock bottle to ensure saturation, and a small quantity of pure mercury. Shake these up well together to form a paste of the consistence of cream. Heat the paste, but not above a temperature of 30 deg. C. Keep the paste for an hour at this temperature, agitating it from time to time, then allow it to cool; continue to shake it occasionally while it is cooling. Crystals of zinc sulphate should then be distinctly visible, and should be distributed throughout the mass; if this is not the case, add more crystals from the stock bottle, and repeat the whole process.

This method ensures the formation of a saturated solution of zinc and mercurous sulphates in water.

To set up the Cell.

The cell may conveniently be set up in a small test tube of about two centimetres diameter, and four or five centimetres deep. Place the mercury in the bottom of this tube, filling it to a depth of, say, .5 centimetre. Cut a cork about .5 centimetre thick to fit the tube; at one side of the cork bore a hole through which the zinc rod can pass tightly; at the other side bore another hole for the glass tube which covers the platinum wire; at the edge of the cork cut a nick through which the air can pass when the cork is pushed into the tube. Wash the cork thoroughly with warm water, and leave it to soak in water for some hours before use. Pass the zinc rod about one centimetre through the cork.

Contact is made with the mercury by means of a platinum wire about No. 22 guage. This is protected

from contact with the other materials of the cell by being sealed into a glass tube. The ends of the wire project from the ends of the tube; one end forms the terminal, the other end and a portion of the glass tube dip into the mercury.

Clean the glass tube and platinum wire carefully, then heat the exposed end of the platinum red hot, and insert it in the mercury in the test tube, taking care that the whole of the exposed platinum is covered.

Shake up the paste and introduce it without contact with the upper part of the walls of the test tube, filling the tube above the mercury to a depth of rather more than one centimetre.

Then insert the cork and zinc rod, passing the glass tube through the hole prepared for it. Push the cork gently down until its lower surface is nearly in contact with the liquid. The air will thus be nearly all expelled, and the cell should be left in this condition for at least 24 hours before sealing, which should be done as follows:

Melt some marine glue until it is fluid enough to pour by its own weight, and pour into the test tube above the cork, using sufficient to cover completely the zinc and soldering. The glass tube containing the platinum wire should project some way above the top of the marine glue.

The cell may be sealed in a more permanent manner by coating the marine glue, when it is set, with a solution of sodium silicate, and leaving it to harden.

The cell thus set up may be mounted in any desirable manner. It is convenient to arrange the mounting so that the cell may be immersed in a water-bath up to the level of, say, the upper surface of the cork. Its temperature can then be determined more accurately than is possible when the cell is in air.

In using the cell sudden variations of temperatures should as far as possible be avoided.

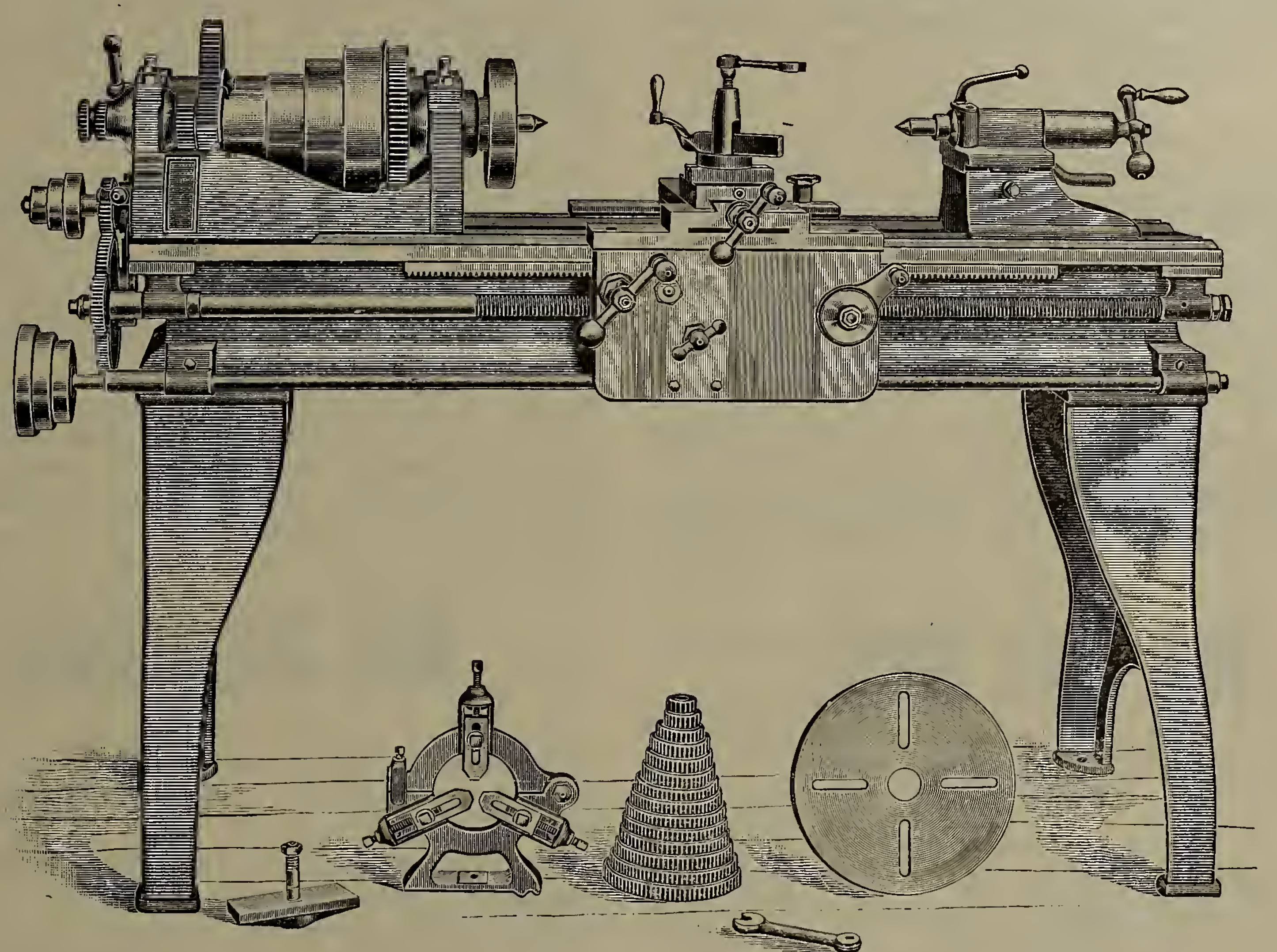
The form of the vessel containing the cell may be varied. In the H form, the zinc is replaced by an amalgam of 10 parts by weight of zinc to 90 of mercury. The other materials should be prepared as already described. Contact is made with the amalgam in one leg of the cell, and with the mercury in the other, by means of platinum wires sealed through the glass.

PRENTISS ENGINE LATHE.

The accompanying illustration is of one of the well-known Prentiss Standard Engine lathes, made by the Prentiss Tool and Supply Company, 115 Liberty street, New York.

This lathe has a 13-inch swing, with raise and full rest. It is designed so as to give strength as well as accuracy, and ease and quickness of operation. The spindles are hollow and made from high carbon steel, and the lead and all actuating screws, racks and pinions are made of solid steel. These lathes are furnished with raise and fall, plain gib or compound rests, and with taper attachment and power cross-feed when required.

This lathe is an especially fine tool, and particularly adapted for all classes of electrical work where accuracy of gauge and finish is essential



PRENTISS ENGINE LATHE.

THE STANDARD UNDERGROUND'S NEW CHICAGO MANAGER.

The Standard Underground Cable Company has just closed a contract with Mr. J. R. Wiley to represent them in the West with headquarters in the Rookery Building, Chicago. Mr. Wiley is well known in electrical circles, having been connected with electrical enterprises for many years, including eight years in the Metropolitan Telephone and Telegraph Company, as superintendent of private lines. He is a brother of Mr. Geo. L. Wiley, who has represented the Standard Underground Cable Company in New York and the East for the past ten years Mr. J. R. Wiley assumes the management of the Western Sales' Department, made vacant by the untimely death of the well-known and popular Fred. E. Degenhardt, and was Mr. Degenhardt's personal friend. Mr. Wiley is a western man and his family are Chicagoans. The Standard Company is indeed fortunate in securing the services of so able a gentleman to represent them at this important point. Since the death of Mr. Degenhardt the company has taken its time in order to find the person best qualified to fill the position, and the selection of Mr. Wiley is an acknowledgment of his worth. With Geo. L. at New York, and J. R. at Chicago, the company interests are in safe hands.

HOW THE TELEGRAPH WORKS.

Two darkies were exercising their brains on scientific matters when they ran up against the telegraph. Sam wondered how messages could be sent over a wire, and Ebenezer, not wishing to appear ignorant, sought to explain the mystery in the following manner:

"S'pose dar am a dog free miles long—"

"Go way, you fool niggah, dar nebber was sich a big dog," interposed Sam.

"But s'posin dar was, and his front paws was on de Hoboken sho' an his hind feet on de New Yoke sho'. Now, s'posin you step on dat dog's tail on de New Yoke sho' whar'll dat dog bark?"

"In Hoboken, I guess," replied Sam.

"Well, dat's jess de way de telegraf works," remarked Ebenezer triumphantly.

RELAXATION.

The sting of an insult is no comparison with the sting of a Jersey mosquito. That is the reason you cannot successfully insult a Jerseyman.

When intoxicated, a Frenchman wants to dance, a German to sing, a Spaniard to gamble, an Englishman to eat, an Irishman to fight, and an American to make a speech.

Drafts payable "at sight" should never be presented to a blind man.

Doctors cover up their mistakes with earth; bank tellers theirs with ink.

The reason jokes do not bear repetition is because having been cracked once their value is impaired.

New York Notes.

OFFICE OF THE ELECTRICAL AGE,
WORLD BUILDING, NEW YORK,
FEBRUARY 11, 1895.

The employés of Zimdars & Hunt, 127 Fifth avenue, city, will give their annual ball at Lyric Hall, on February 22.

Zimdars & Hunt, 127 Fifth avenue, city, have been awarded the contract to install a complete electric light plant for 1200 lights in the new grammar school building, on Edgecombe avenue, 140th and 141st streets, city.

H. E. Webb, of the Solar Carbon Mfg. Co., Pittsburgh, Pa., is in town. He reports brisk demand for the wire gauze carbon brush which was brought out by his company in May, 1894.

Mr. A. D. French, the lumber dealer, 200 Broadway, New York, makes a specialty of cedar telegraph poles, telegraph cross arms and yellow pine octagonal poles. The latter are treated against decay by the use of a special preservative.

The Garvin Machine Co., Laight and Canal streets, New York City, manufactures among many other machines the finest tools and machines used in the construction of electrical testing instruments. This company manufactures machines for turning, boring and planing large dynamo castings, screw-cutting machines, milling and tapping machines, cutter grinders, lathes, drill presses of all kinds, etc., etc. The company has a large stock of new and second-hand tools and machines needed for all kinds of metal working machinery. They have been in the business many years and know just exactly what is needed in the manufacturing trade; and those needing machines, tools, etc., in this line, should first communicate with the Garvin Machine Company.

The Lightning Lathe and Planing Tool of Gould & Eberhardt, Newark, N. J., is a great saver of time and money, and successful manufacturers cannot afford to be without one of these machines. Wherever they are used they are giving the best of satisfaction and save both money and time always.

C. J. Bogue, 206 Centre street, New York City, is very busy just now and has a large number of commutators on hand to be refilled with Billings and Spencer's dropped forged copper segments. Mr. Bogue manufactures supplies for the American arc lamps and dynamos.

The Solar Arc Lamp Co., 351 Jay street, Brooklyn, N. Y., has appointed the following named firms as its agents, viz: The Commonwealth Construction Co., 413 Market street, Philadelphia, Pa.; Royce & Marean, 1410 Pennsylvania avenue, Washington; John M. Wright, Mills Building, San Francisco, Cal. Mr. J. M. Young, general manager of the company, has just returned from Pennsylvania, where he secured a large order for Solar ornamental lamps, to be installed in one of the most prominent buildings in Pennsylvania. The company has just filled an order for 46 ornamental and plain lamps to Australia: the order came through the San Francisco agent of the company. Solar lamps have been running in the dry goods store of F. M. Hirsh, on Grand street, New York, for nearly six months, and have given the best of satisfaction. This is the lamp that attracted so much attention lately in front of the Morton House, on account of its neat appearance and steady light. The claims for these lamps are steady burning, and the impossibility of one lamp taking all the current or robbing from the other when they are in circuit. The business of the company has increased so much that a large testing room and manufacturing department have been added. W. T. H.

New Corporations.

Harrison Electric Co., Chicago, Ill., by Edward M. Harrison, Lewis H. Painter and Lewis Rinaker. Capital stock, $500,000.

The Somerset Traction Co., Augusta, Me., by R. B. Shepherd, Thos. H. Anderson, Joseph P. Oak and others. Capital stock, $200,000.

The Wiscasset and Moosehead Lake Telegraph and Telephone Co., Wiscasset, Me., by Henry Ingalls, Alfred Lenox, Richard T. Rundlett, William G. Hubbard and others.

The Boonsboro and Keedysville Electric Railway, Boonsboro, Md, by Dr. A. W. Lakin, S. S. Davis, Samuel Knoce, A. C. Huffer, J. C. Brining, D. W. Barkman and H. S. Beard.

The Electric Purifier Co., Chicago, Ill, by W. T. Rankin and others. Capital stock, $300,000.

The Phœnix Telephone and Electric Co., Denver, Col., by P. H. Baker and others. Capital stock, $750,000.

A $10,000 electric light company has been organized in Neoshoe, Mo., by Jonn McElhany.

The Associated Water, Gas and Electric Light Co., Nevada, Mo., by F. J. Tygard, president, and C. F. Strohm, secretary and treasurer.

The San Antonio Electric Co., San Antonio, Texas, by E. J. O'Beirne and Wm. H. McGraw, of San Antonio. Capital stock, $100,000.

The Clarksville Telephone Co., Clarksville, Ky., by Capt. E. P. Gracey, Hon. D. N. Kennedy, M. Savage, H. Owen, R. H. Burney and James Bowling.

The Frankfort and Utica Street Railway Co., Frankfort, N. Y., by John V. Quackenbush, of Mohawk, Clinton Beckwith, Glen P. Munson, B. F. Witherstine, Chas. G. Grosvenor and others. Capital stock, $70,000.

Possible Contracts.

The Plainfield Street Railway Co., Plainfield, N. J., has petitioned for permision to extend its lines.

The taxpayers of Mexico, N. Y., have voted in favor of establishing a municipal plant in that place.

There is some talk in Geneseo, N. Y., of building an electric road from that place to Long Point, a distance of six miles.

The Electric Railway Co., of York, Pa., proposes to extend its lines to various places in that vicinity.

The Western Telephone Construction Co., Chicago, Ill., has been awarded the contract for equipping the Interior Department, Washington, D. C., with its telephone system.

It is proposed to utilize the water power of the St. Joseph river for generating electricity for light and power purposes and to supply Elkhart and neighboring cities with current.

It is reported that the Tamaqua and Pottsville Electric Railroad Co., Pottsville, Pa., will build its lines between the two cities.

An appropriation of $70,000 has been asked for the purchase of an electrical plant to improve the ventilation of the National House of Representatives, Washington.

A movement is on foot to organize a company for the purpose of building an electric road between Remsen and Hinckley, N. Y., a distance of five miles. The Trenton Falls Lumber Co., Remsen, N. Y., can give further information.

The United Electric Co. has applied for a telephone franchise in Minneapolis, Minn.

The Portland Railroad Co., Portland, Me., has applied for permission to change its lines to the trolley system.

The City of Columbia, Ala., is contemplating establishing an electric light plant. Geo. L. Campbell can give further information.

The Mayor of Union Springs, Ala., can give information concerning the proposed issue of $30,000 in bonds for an electric light plant and water-works in that place.

The Bell Telephone Company proposes to establish a telephone exchange in Tallahassee, Fla.

An electric light plant is to be installed in the Catholic University, Washington, D. C. Further information can be obtained by addressing Bishop Keane.

The Jasper County Electric Light Co., Carthage, Mo., proposes to establish a new power-house.

It is proposed in Greensboro, N. C., to issue $25,000 in bonds for the purpose of building an electric light plant. The mayor can be addressed for further information.

The plans for the contemplated electric light plant in Lynchburg, Va., have been prepared by D. E. Evans, of Baltimore, Md. The mayor of Lynchburgh can give further information.

John Huebner, Baltimore, Md., can give information regarding a $100,000 hotel to be erected in Catonsville, Md.

Buildings which may require electrical plants are to be constructed in the following-named places: Baltimore, Md., a theatre by Jas. L. Kernan; Baltimore, St. Elizabeth's Home, by J. T. Buckley; Baltimore City College, Henry S. Rippel, contractor; Union depot, Brunswick, Ga., by Brown & Garber; Masonic Temple, St. Louis, Mo., address S. M. Kennard.

There is talk of building a trolley line between Farmville and Keysville, Va., a distance of 20 miles.

The electric question is being agitated in Fox, Lake Wis.

Secretary Smith of the Board of Trade, Lowell, Mass., can give information regarding the proposed establishment of mills in that place.

It is reported that the Staten Island Rapid Transit Co. intends to substitute electricity for steam on its lines and extend its system to the interior of the Island.

A bill has been introduced in the National House of Representatives to incorporate the Washington and Brighton Railway Co. The company proposes to operate an electric railway between Washington and Chesapeake Bay.

There is some talk in Howard City, Mich., of establishing an electric light plant in that city.

The Detroit Railway Co., Detroit, Mich., will build a power-house and three car barns. H. A. Everett, general manager, and J. F. Randall, engineering and mechanical engineer, can give further information.

The Phœnix Telephone Co., of Indianapolis, Ind., will install an independent telephone exchange in Upper Sandusky, Ohio. G. W. Hale & Co. are the contractors.

The Syracuse Street Railroad Co., Syracuse, N. Y., contemplates the erection of a large brick repair shop.

The City and Suburban Electric Railroad Co., Manchester, N. H., has been incorporated by John C. Ray, O. D. Knox and Fred. T. Dunlap.

It is reported that an electric railway is to be built between Bethlehem and Nazareth, Pa.

The Board of Administration of the city of Cincinnati, O., will receive bids until February 15 for the electric wiring of a new market-house which is to be built. Samuel Hannaford & Sons, Cincinnati, are the architects of the building.

PHOENIX WILL ARISE FROM THE ASHES.

The factory of the Phoenix Glass Company, at Monaca, Pa., was destroyed by fire on February 3. Mr. A. H. Patterson states that a new fire-proof building will be erected at once; in the meantime another building has been leased temporarily and there will be no interference whatever with business. The company will fill all orders as promptly as usual.

EXHIBITS AT THE NATIONAL ELECTRIC LIGHT CONVENTION.

No special arrangement has been made for the exhibition of supplies, etc., in connection with the convention of the National Electric Light Association in Cleveland, on the 19th, 20th and 21st instants. What exhibits there are will be made in the rooms of the hotel, the heavy exhibits being placed in the basement.

Trade Notes.

The Adams & Bailey Electric Co., Elkhart, Ind., is so rushed with orders for its well-known transformers that it is necessary to keep the factory running night and day to fill the orders promptly. The company intends to establish selling agencies all over the United States. The firm now has 25 skilled workmen in its employ and will engage more as fast as needed, so that it can fill the largest orders on short notice. The company's motto is, "quick sales, low price and small profit." All this company's transformers are guaranteed. See the company's advertisement on another page for further details.

WOVEN WIRE BRUSHES.

The Belknap Motor Co., of Portland, Maine, are the patentees and manufacturers of the best woven wire commutator brush on the market.

Electrical and Street Railway Patents.

Issued February 5, 1895.

533,421. Car-Truck. James M. Austin, Tyrone, Pa. Filed Aug. 14, 1894.

533,425. Automatic Car-Fender. Henry P. Barney, Washington, D. C., assignor to the Carr & Barney Manufacturing Company, of Virginia. Filed Nov. 9, 1894.

533,427. Automatic Telephone-Switch. Henry D. Bayne, Brooklyn, N. Y. Filed May 31, 1894.

533,434. Rosette for Electric Lighting. Elisha W. Buffinton, Fall River, Mass., assignor of one-half to Albert F. Dow, same place. Filed Oct. 6, 1894.

533,445. Electric Dental Motor Apparatus. Francis N. Denison, Toronto, Canada. Filed May 26, 1894.

533,447. Electric Railway. John G. Douty, Williamsport, Pa., assignor of two-thirds to James N. Klin and William G. Elliot, same place. Filed May 17, 1894.

533,459. Electrically-Lighted Buoy. Ira W. Henry, New York, N. Y. Filed May 29, 1893.

533,485. Car-Brake Adjuster. Martin E. McKee, St. Paul, Minn. Filed Dec. 26, 1893. Renewed Oct. 29, 1894.

533,490. Electric Fire-Alarm and Police-Signal Box. George E. Paynter and William H. Thompson, Richmond, Va. Filed May 4, 1894.

533,497. Safety Apparatus for Street-Railway Cars. Oswald R. Routh, Jersey City, N. J. Filed May 19, 1894.

533,502. Method of and Means for Testing Incandescent Lamps. Frank S. Smith, Pittsburgh, and James A. Vandegrift, Allegheny, Pa. Filed July 9, 1894.

533,528. Safety Attachment for Street-Cars. Carl E. R. Christensen, Brooklyn, N. Y. Filed Dec. 23, 1893.

533,562. Cable Railway. Minott W. Sewall, New York, N. Y. Filed Jan. 18, 1893.

533,565. Car-Fender. Friedrich Sprick, West Hoboken, N. J. Filed Sept. 10, 1894.

533,583. Brush for Dynamo-Electric Machines. Joseph W. Dickey, New York, N. Y., assignor of one-half to Charles E. Chapin, same place and Milford, Conn. Filed Dec. 8, 1894.

533,598. Running-Gear for Electric Cars. Charles A. Jackson, Reading, Mass. Filed Sept. 15, 1893.

533,610. Conduit Electric Railway. Alfred Rosenholz, San Francisco, Cal., assignor of one-half to Samuel J. J. Clarke and Harvey S. Brown, same place. Filed May 22, 1894.

533,619. Telephone Arm-Rest and Receiver-Holder. William Steubing, Cincinnati, Ohio, assignor of one-half to Frank A. Leininger, same place. Filed Oct. 30, 1894.

533,627. Conduit Electric Railway. William H. Baker, Pawtucket, R. I. Filed May 18, 1894.

533,631. Subway for Electric Railways. Frank E. Button, Rochester, N. Y. Filed June 6, 1894.

533,632. Safety-Guard for Cars. Samuel F. Clouser, Brooklyn, N. Y., assignor of one-half to John S. Collins, same place. Filed May 19, 1894.

533,670. Lock for Electric Lamps. Warren A. Saul and Jacob H. Peck, Steelton, Pa. Filed Mar. 13, 1894.

533,698. Safety Connection for Electric Conductors. Ralph E. Bates, Brooklyn, N. Y., assignor of one-half to James S. Topham, Washington, D. C. Filed June 20, 1894.

533,729. Telephone or Analogous Electrode. Thomas McCowbray, New York, N. Y. Filed Aug. 9, 1894.

533,772. Trolley for Underground Conduits. Charles M. Yost, Washington, D. C., assignor of forty-one eightieths to Gabriel Edmondston, Lemuel F. Burner, and Georgianna T. King, same place. Filed Nov. 3, 1894.

533,785. Telephone-Exchange. Morgan Brooks, Minneapolis, Minn. Filed Oct. 17, 1894.

533,791. Electric Bathing Apparatus. Charles Doehring, New York, N. Y. Filed June 22, 1894.

533,795. Electric Broiler or Toaster. Levi T. Edwards, Haverford, Pa. Filed Mar. 2, 1894.

533,836. Conduit System. Charles M. Yost, Washington, D. C., assignor of forty-one eightieths to Gabriel Edmondston, Lemuel F. Burner and Georgianna T. King, same place. Filed Nov. 3, 1894.

533,845. Car-Fender. John H. Faulstich, New York, N. Y., assignor of five-sixths to George Kraus and Frederick Hausman, same place, and Charles W. Stringham and John A. Williams, Brooklyn, N. Y., and George H. Thompsom, East Orange, N. J. Filed Mar, 14, 1894.

533,853. Cover for Electric-Light Globes. Hans Johansen, Chicago, Ill. Filed June 30, 1893.

ELECTRICAL AGE

VOL. XV., No. 8. NEW YORK, FEBRUARY 23, 1895. WHOLE No. 406

ESTABLISHED 1883.

Entered at New York P. O. as second-class matter, January 18, 1891.

THE ELECTRICAL AGE PUBLISHING CO., PUBLISHER

TERMS OF SUBSCRIPTION:

One Copy, one year,	$3.00
One Copy, six months,	1.50
Great Britain and other Countries,	4.00

Cable Address (all Cables,) "Electage," New York.

W. T. HUNT, President. F. N. BASSETT, Vice-President.

T. R. TALTAVALL, Secretary and Editor.

NEWTON HARRISON, E. E., Scientific Editor.

ADDRESS ALL COMMUNICATIONS TO

THE ELECTRICAL AGE PUBLISHING COMPANY,

FIRST FLOOR, WORLD BUILDING.

NEW YORK.

NEW YORK, FEBRUARY 23, 1895.

CONTENTS.

THE CONVENTION PROGRAMME.

You will find the complete programme of the convention on another page in this issue. Read it carefully and attend all the meetings you possibly can. You will find such use of your time both profitable and interesting.

THE ELECTRIC SPECIAL.

An interesting and representative party came from the East on the special train from New York.

There is only one man who can make these special trains a success, and his name is BAKER. He knows just what to do to make things pleasant for everybody. Three cheers for Cyrus O. Baker, jr.

ELECTRICAL AGE SOUVENIR.

Call at the ELECTRICAL AGE headquarters at the Hollenden, register your name and receive a souvenir.

REGISTER YOUR NAME.

The ELECTRICAL AGE desires every delegate at the convention to register his name on its register, so that they may have a complete list of the attendants for publication. Do not fail to attend to this duty.

WHO IS HE?

The next president of the National Electric Light Association is a man of sterling integrity and one of the most progressive spirits in the community in which he resides. No one is better qualified to fill the position, and he enjoys the confidence and respect of all who have the honor of his acquaintance. We know what we are talking about.

AT CLEVELAND.

Cleveland is honored this week. The most progressive men of the period are within her limits and the whole atmosphere is surcharged with electricity. It is safe to say that the city has never had so many men of prominence as her guests before, and there is every indication that they will make their presence felt. Science and practice meet on the level to discuss the latest developments in the greatest of modern industries—electric lighting. We hope all the delegates will enjoy their visit to the Forest City and derive much profit therefrom.

MAGNETIC MECHANISM.

The excellent article of Dr. Wilbur M. Stine, of the Armour Institute, Chicago, entitled "Magnetic Mechanisn," which was concluded in our issue of last week, has attracted wide attention on account of the clear manner in which the author's views are set forth and their originality. The first portion of the article appeared in our issue of February 2. Dr. Stine has in this contribution, given abundant evidence of original ideas, and he proposes a universal and very simple rule for ascertaining the direction of induced current, etc. He employs mechanical analogies as aids to a better comprehension of the phenomena involved, and as the article is so plainly written there is no doubt that it will materially aid the student in his mental labors Dr. Stine's articles will also be of great value to the practical man. A clear conception of the phenomena involved in any science opens the path for the practical application of our knowledge on the subject. The conceptions of electro-magnetic phenomena are as a rule rather cumbersome and unsatisfactory, but those who compare Dr. Stine's ideas on the subject, as expressed in his article, with those of his contemporaries cannot fail to give him credit for materially clearing the way to a better understanding of this hitherto difficult subject.

CLEVELAND, THE CONVENTION CITY.

None of the Western cities offers better advantages for the holding of a large convention than Cleveland. It is centrally located geographically and possesses the finest hotels to be found between New York and Chicago, and in all respects offers every inducement and convenience for a large representative gathering.

Cleveland was founded in 1796 by Gen. Moses Cleaveland, one of the directors of the Connecticut Land Co., in whose honor the place was named. The section of territory owned by the Connecticut Land Company was called the "Western Reserve," and it still goes by that title. It embraces the best part of the State, and many of its oldest inhabitants still refer with pride to their Yankee ancestry.

Four years after the place was founded, in 1800, a permanent settlement was accomplished, and in 1814 the legislature incorporated the village of Cleveland. In 1836 a city charter was obtained, and in 1855 the annexation fever broke out among its citizens and they gathered into the municipal fold "Ohio City," which was located on the west side of the Cuyahoga river, and which had previously maintained a separate existence. Ohio City, as a name, is now quite forgotten, and the section of the city which was formerly known as Ohio City is now called the "West Side."

Cleveland has always been a rapidly growing city. In 1810 it had a population of 57; in 1890 it had 262,000, and at the present time its population is over 325,000.

In 1832 the Ohio canal was completed; this canal gave

MAP OF BUSINESS SECTION OF CLEVELAND.—HEAVY BLACK LINES STREET CAR ROUTES.

communication with Cincinnati. About the same time the harbor was greatly improved and channels cut, Congress having appropriated $5,000,000 for the purpose. These increased facilities gave a great impetus to lake commerce with Cleveland, in 1844 its value being $20,000,000. Nine years later, in 1853, it increased to $87,000 000, and has continued increasing ever since, Cleveland being now the chief lake port, excepting Chicago.

SUPERIOR STREET VIADUCT, CLEVELAND.

Cleveland's educational institutions are second to none, and the citizens take great pride in them, as they do in all of their public institutions. The fire department ranks among the foremost for system and discipline. In 1850 the modern conveniences, gas and the telegraph were introduced, and Cleveland has continued ever since to grow and develop at a prodigous rate.

The city has many noted examples of skill in the arts

and sciences. The viaducts which span the Cuyahoga valley and connect the eastern with the southern and

VIEW OF PUBLIC SQUARE, CLEVELAND.

western portions of the city are celebrated as examples of engineering skill. The Superior street viaduct was the first one built, and has a total length of 3,211 feet and

LEVELAND HEADQUARTERS NATIONAL ELECTRIC LIGHT ASSOCIATION.

cost $2,250,000. It was dedicated on December 27, 1878, its construction taking over four years.

The Central viaduct is 5,229 feet long, being but 51 feet short of a mile; it cost $675,574, and took nearly three years to build. Before these viaducts or high-level bridges were erected it was necessary in crossing from the west and south sides to the east side, and vice versa, to descend a steep grade into the valley, and ascend a similar grade on the opposite side.

Cleveland is noted for its magnificent streets and residences. Euclid avenue is the pride of the Clevelanders, and with good reason, for it would be hard to find a more beautiful thoroughfare anywhere. It is six miles in length, 100 feet wide and paved with Belgian blocks. A broad stretch of parkway extends along each side, and two rows of trees border these parks. The trees are old and stately, and in many cases their branches meet over the centre of the street. Magnificent residences, sur-

THE "ARCADE," CLEVELAND.

rounded by acres of beautiful and well-kept grounds, line the avenue. The grounds in many instances are so large

that they are veritable parks, and form one of the most attractive features of the Forest City.

Prospect street follows Euclid avenue closely in the matter of beauty, and is one of the finest streets in America. It runs almost parallel to Euclid avenue and is next to it.

Of the business streets Superior street is the main one. It extends from the Cuyahoga river to the city limits, in an easterly direction, and is ten miles long. It is 125 feet in width, and on each side are elegant modern business blocks. The Cleveland City Cable Railway runs the entire length of this street, which during the daytime presents a busy appearance, and is crowded by hurrying business men and all classes of vehicles. From the viaduct to the Public Square there are four street-railroad tracks, the cable line occupying the two in the middle. The "Square" is intersected by Superior and Ontario streets, and is in the heart of the business section. A few doors above the square, on Superior street, the Hollenden Hotel is located. This hotel is the headquarters of the Association.

The "Arcade" runs through from Euclid avenue to Superior street. It is a six-story building of the modern class, with a massive glass roof and mosaic-work floors. The interior is a large court, which is lined with stores where goods of all kinds may be purchased.

In the matter of parks Cleveland is well favored. The Public Square, right in the heart of the business section, is a popular resting-spot and is very attractive, although it is surrounded on all sides by tall business blocks. Besides the Square are Wade Park and Lake View Park. Wade Park was a gift to the city from the late J. H. Wade, one of the telegraph pioneers, and at one time president of the Western Union Telegraph Company. In Lake View Park the Garfield monument is located. This is a magnificent memorial of the late President Garfield. Its interior contains a statue of Garfield, represented in the attitude of addressing an audience. It is an excellent likeness of the great statesman, and the spot is visited by thousands who admired Garfield's genius.

Besides the parks mentioned there are other lesser "breathing spots," the total park area in the city being 93 acres.

GARFIELD'S MONUMENT, LAKE VIEW PARK, CLEVELAND

STATUE OF THE FOUNDER OF CLEVELAND.

The largest ship-building yards on the great lakes are located in Cleveland, and here iron vessels of the largest dimensions are built and fully fitted out. The great express steamers running between Duluth and Buffalo were built in Cleveland. These magnificent vessels are patterned after the modern ocean racers, and are in every way their equals, size for size.

Cleveland's largest business is the iron industry and its various branches. Thousands of tons of steel rails for railroads are manufactured every year, and many of the largest bridge works in the country are located here. Every step of iron manufacture is carried on in a large scale, and what over forty years ago was a small foundry has developed into an industry that is second to none in the country.

The iron ore trade is the basis of a large portion of Cleveland's great industrial prominence.

THE WALKER MANUFACTURING CO.

None of Cleveland's industries is better known than the Walker Manufacturing Co. This large concern about a year ago took up the manufacture of electrical generators and railway motors, and all the accessories of a complete electric railway system. Prior to that time the Walker Company had built up a large reputation for cable railway equipment, power transmission plants and all classes of heavy machinery, but in order to extend the scope of the business an electrical department was established.

The Walker Company has one of the most complete and largest plants in the country, and its equipment is of the most modern character. The buildings are situated on the shore of Lake Erie, on the west side of the city, and cover an area of 250,000 square feet. They are built of brick, iron and glass in the most substantial manner.

The machine shop consists of three long bays, each containing a 30-ton traveling crane running its entire length. At each end are iron galleries which are fitted up as winding rooms and for the manufacture of insulating materials.

The testing room is equipped with every appliance necessary for this particular branch of the work, and a 1,000-H. P. steam plant has just been completed especially for testing large multi-polar generators.

In another building are two large foundries, which have a capacity of 50 tons of iron in a single mould. With these especially large facilities the company is enabled to cast large machines in fewer parts, thus giving them great rigidity.

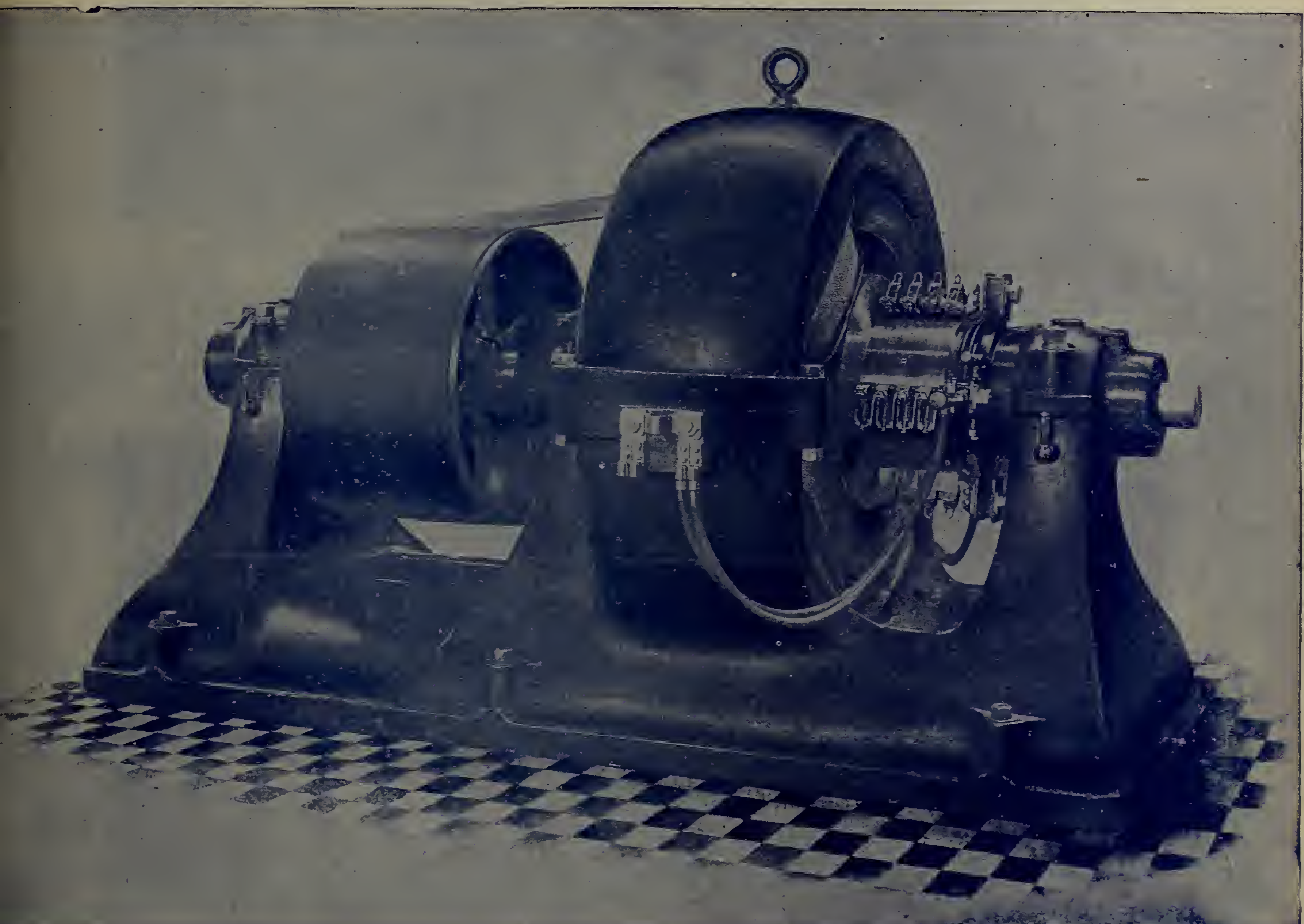
The motor constructed by the Walker Company combines all the features that practical experience has proved to be of value. It is of the 4-pole, single reduction type, and is controlled by a series-parallel controller of very simple and efficient design. The motor is water and dust tight, the only opening being over the commutator for the purpose of gaining access to the brushes.

The frames which are of steel are made in two parts, and the gears and pinions are also of the same metal.

The company manufacture three sizes of motors, Nos. 5, 10 and 15. No 5 is wound for three different outputs, viz. 20, 25 and 30 H. P. The No. 10 machine is designed for heavier work, and wound for 40, 50 and 60 H. P., while No. 15 is built to meet the requirements of locomotive, elevated railway, mining and other similar service.

The points of superior excellence possessed by these motors are: suspension, strength and weight, accessibility, protection of working parts, interchangeability of wearing parts, exclusion of oil and grease; perfect insulation and the elimination of noise.

The armature is of the toothed drum type; the field magnets are of the 4-pole type, and the field coils are machine wound. All of the accessory apparatus are of the most approved and efficient design, and altogether the system is claimed to be the leader in efficiency.



250 K.W. BELT-DRIVEN WALKER GENERATOR.

The Walker direct current power generator is notable for its beauty and strength of design and high commercial efficiency.

The armature is of very low resistance and will stand an overload of 50 per cent. without sparking or danger of injury. The insulation is thorough and is everywhere tested for 5,000 volts alternating current.

The magnets are of the iron-clad type, the coils being machine wound, the shunt and series being made up in separate independent bobbins. The poles are made of soft laminated iron, cast into the yoke, and all heating

from eddy currents is entirely overcome. The magnet yoke is cast in two pieces, the top being removable when it is desired to remove the armature.

The generators are compound wound and can be made to over-compound any amount desired, up to 20 per cent. They are provided with a hand regulator for adjusting the shunt coil.

The bearings are of the ball and socket self-oiling type, and the brushes and brush holders are of the best design.

The company's standard switchboard is of the panel type, each panel containing all the necessary instruments, switches, etc., corresponding to one generator.

The works of the Walker Manufacturing Company are said to be probably better equipped for the manufacture of high-grade heavy machinery than any other works in the country. The same methods that have earned for them the reputation of being without an equal as builders of cable railway and power transmission machinery are being vigorously applied in their electrical department. The tracks of the Lake Shore and Michigan Southern Railway Company enter the testing room below the floor level and all finished machinery can be placed directly on cars.

The works no doubt will be one of the attractions to the members of the associations during their visit to the "Forest City."

PRESIDENT M. J. FRANCISCO.

The president of the National Electric Light Association, M. J. Francisco, is one of the most active members of that body, and his reputation in electric lighting circles is as wide as the country itself.

Mr. Francisco was born on the fifth day of August, 1835, at Westhaven, Vt. At the age of sixteen years he entered Oberlin College, Oberlin, Ohio. After completing his studies there he passed several years travelling through the West and South, visiting all states then admitted to the Union. He returned to Vermont in 1859, returning West again in October, 1860, as principal of the Northwestern Commercial College, at Fort Wayne, Ind. Here he resided during the first years of the rebellion, and took an active part in raising volunteers for the Union cause and in circumventing the schemes of the Knights of the Golden Circle and Ku-Klux Klan.

In 1864, Mr. Francisco accepted the presidency of the Pennsylvania College of Trade and Finance, at Harrisburg, and organized a large and flourishing institution, where many men, now at the head of influential corporations, received their first knowledge of commercial principles.

PRESIDENT M. J. FRANCISCO.

Mr. Francisco, for several years afterwards, represented in Rutland various foreign insurance companies, the territory over which he had supervision embracing the states of Vermont, New Hampshire and Northern New York. He became an authority in insurance matters and gained the reputation of being a most conservative and successful manager.

In 1887 he was elected president of the Rutland Electric Light Company. Appreciating the importance of electri-

(*Continued on Page 112.*)

FOUNDRY NO. I, WALKER MANUFACTURING CO., CLEVELAND.

THE HANDLING OF COAL AND ASHES.

The problem of handling coal and ashes is one of great interest to engineers designing or in charge of power plants. It is also a problem that admits of solution in such a manner that a great saving may be made in the operating expenses.

In electric lighting and power stations it is required to convey the coal from the receiving point to the furnaces, remove the ashes to some receptacle from which they can be easily taken away, and to accomplish this at the lowest possible cost per ton. In many cases this is not a simple engineering problem, but is so affected by the environment as to make it complex and difficult.

The C. W. Hunt Company, 45 Broadway, New York City, has been prominently identified with the development of coal handling machinery and installed the apparatus for that purpose in use at the third district station of the Brooklyn Electric Illuminating Company, Pearl and Gwinnett streets, Brooklyn, N. Y.

This station is situated some distance from the coal wharves and the coal is delivered by wagons. It was necessary to take the coal from the wagons, carry it to the furnaces, and also to remove and dispose of the ashes. The arrangement of the machinery installed for this purpose is shown in Figs. 1 and 2.

The coal is carried from the hopper underneath the sidewalk to the coal tanks above the boilers by a conveyor, which upon its return passes underneath the ash-pit of the furnaces and carries the ashes to a bin, from which they can be drawn at will for removal.

The conveyor consists of a series of gravity buckets pivoted in a double chain, and the whole system is carried on self-lubricating wheels.

The buckets are so pivoted in the double chain that the force of gravity keeps them always in an upright position, whether full or empty, and no matter how tortuous the track over which they are drawn.

The conveyor possesses several features that are peculiarly desirable for this work. The material is carried to its destination by a single conveyor in a horizontal, vertical or angular direction, all of which were utilized in this station. The change in the direction of the conveyor is made by running around curves instead of over sprocket wheels, and the whole machine is noiseless in its operation.

The chain is driven by pawls instead of by sprocket wheels, avoiding entirely the destructive wear heretofore inherent in conveyors, especially as the material does not come in contact with any working part of the conveyor to cause wear.

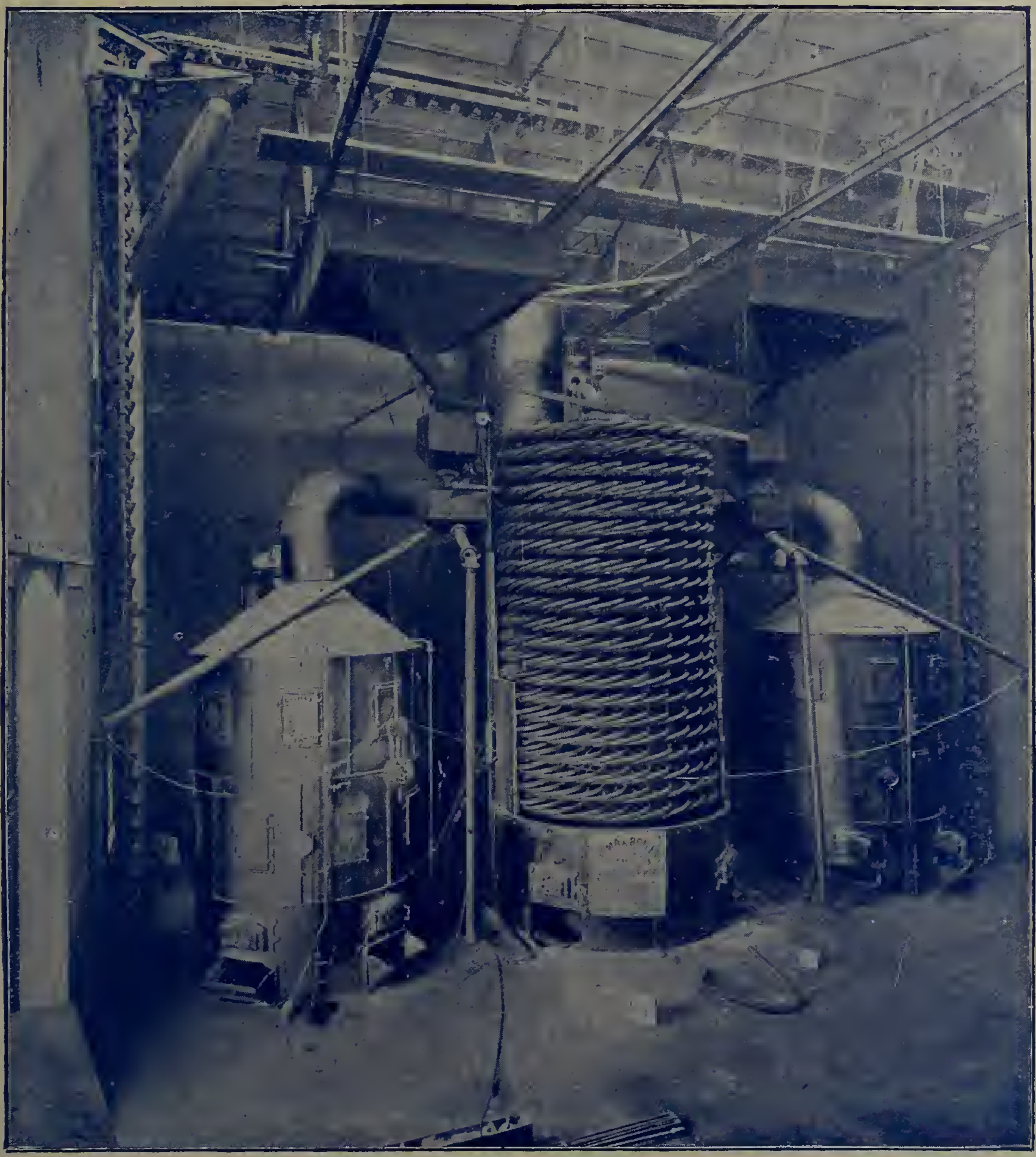


FIG. 1—A BOILER ROOM OF THE EDISON ELECTRIC ILLUMINATING CO., BROOKLYN, N. Y., SHOWING HUNT COAL HANDLING MACHINERY.

The conveyor is moved slowly, the capacity being obtained by the size of the buckets and not by the speed of the chain.

In this station the necessity for a special method of filling the buckets under the sidewalk will be apparent when it is considered that the buckets swing freely on pivots, and might oscillate to a harmful extent or might be loaded on one side and remain at an angle during the trip. The loading is accomplished by a continuous filler, and so perfectly that it would not occur to an observer that there was any liability of swinging or uneven loading.

The filler guides the coal into the buckets, filling each one as it passes.

The power for driving the conveyor is located at the top line and is furnished by a ten horse-power electric motor. The operating switches are placed below on the boiler room floor for convenience in starting and stopping the machinery. At this station when receiving coal at its full capacity, the power required to operate the conveyor is 4½ horse-power, measured at the switch.

The coal is drawn from the storage bins above the boilers into weighing hoppers, from which it is spouted to the floor of the boiler room at such a distance as to be easily shovelled directly into the furnaces.

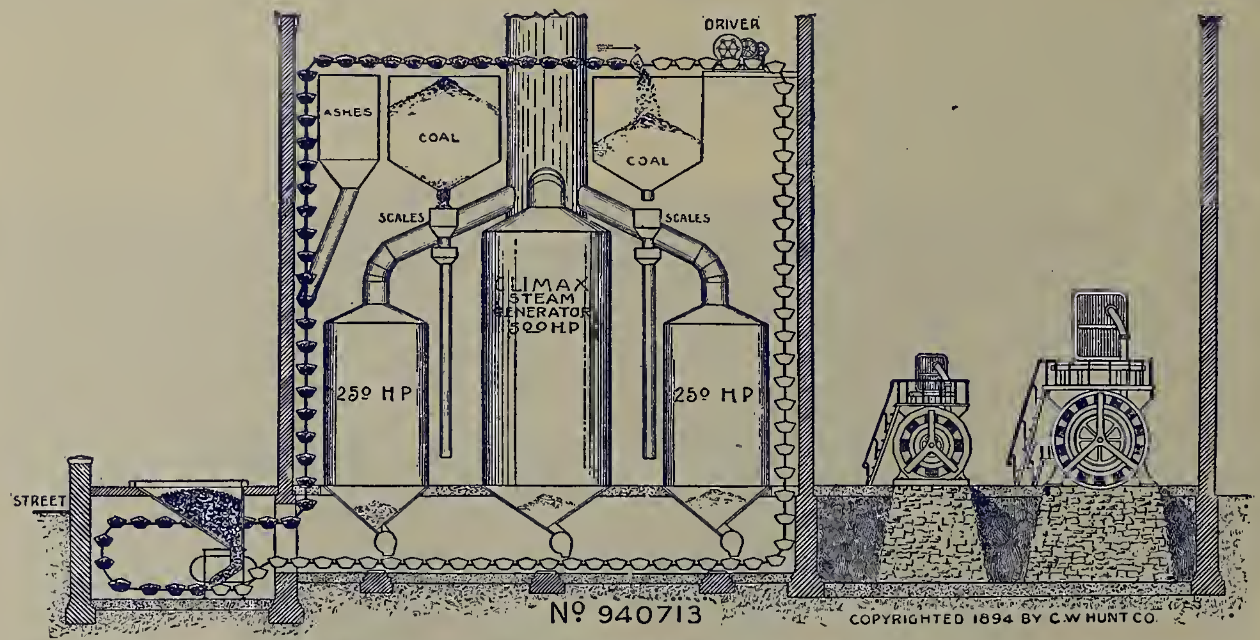


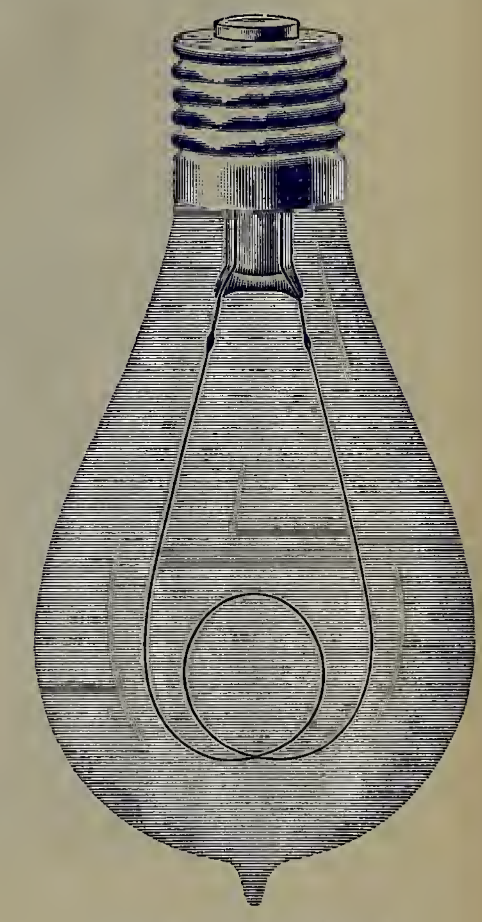
FIG. 2.—SECTIONAL VIEW SHOWING ARRANGEMENT OF THE COAL HANDLING MACHINERY.

Handling ashes, either wet or dry, has heretofore been considered one of the most difficult objects to accomplish, and one of the most destructive to machinery, but in this station is accomplished so completely by the use of a special filler, one of which is placed under each boiler and is always ready for work, that it is as easy to handle the ashes as the coal.

THE BUCKEYE ELECTRIC COMPANY.

Among Cleveland's most prominent industries is the Buckeye Electric Company, the manufacturers of the famous Buckeye incandescent lamps, and as far as the lamp itself is concerned no other has a better reputation for long life and general excellence.

BUCKEYE ELECTRIC COMPANY'S PLANT.—EXTERIOR VIEW.



STANDARD BUCKEYE LAMP.

The Buckeye Electric Company's factory is the largest and best equipped, with one exception, in this country. It is located at 1925 Broadway, Cleveland, and comprises two large buildings and several smaller ones. The principal building is of brick construction, three stories high and has two wings built up to the height of one story with walls heavy enough to carry the structure to the three full stories. The main building is 60 feet front by 150 deep, and in every particular is perfectly suited and equipped for the work carried on within its walls.

Fig. 1 gives an exterior view of the plant. At the extreme right the small building represents the original factory in 1891, and some idea of the immense increase of the business may be gained by a comparison of the size of the plant of today and that of 1891.

Fig. 2 is a view of the engine and dynamo room. The power plant consists of one 100-H. P. Corliss engine and one 75-H. P. New York Safety engine. The boilers are of the return tubular type and were made by the Babcock & Wilcox Company. A variety of dynamos are found in this plant—three of the C. & C. Electric Company, two Excelsiors, one Kimball, three Continental and three P. Claus machines.

The Buckeye lamp filament differs radically from any other manufactured and its superiority is demonstrated by the economy, uniformity in candle-power and long life of the lamps. The Standard lamps with coiled filament are made of 10, 16, 20, 25, 32, 50 and 100 candle-power. The same powers except 100 candle-power are adopted in the

50–52 volt lamps, with loop filament. The Buckeye "special" lamp is designed for steamer, household and decorative lighting, and is only 4¼ inches in length. The railway lamp has an anchored filament and is of 20 candle-power. The standard efficiency of the Buckeye lamps is 3.5 watts per candle.

The Buckeye Electric Company's head offices are at No. 401–404 Cuyahoga Building, Cleveland, Ohio. The officers of the company are: J. Potter, president; F. H. Prentiss, vice-president; Chas. H. Rockwell, secretary and treasurer, and Arnold Spiller, superintendent.

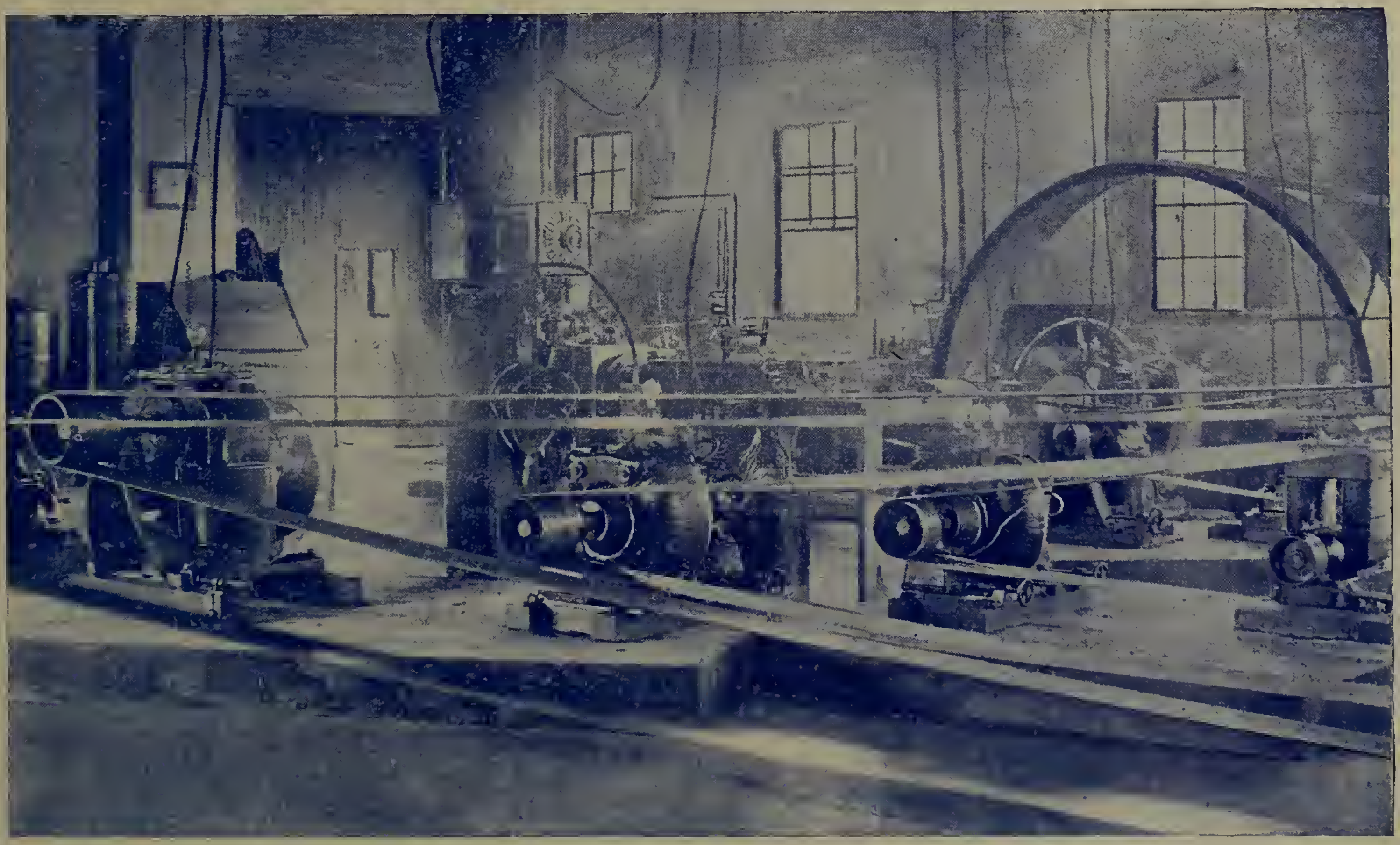
THE MULTIFUSE SWITCH.

This invention is a combination of a first-class switch and four or more fuses. By reference to the accompanying illustration, the working and the purpose of the invention is perceived at a glance.

A porcelain base has upon it a rotating porcelain fuse block carrying separable porcelain metal-tipped fuse holders to the number of four or more, which fuse holders, when placed in position in the rotating fuse block, cover the fuses in separable porcelain channels, so that when a fuse burns out there is no liability of contact with any other part of the device. On the blowing of a fuse all that is necessary to have the light in operation again is to give the switch a quarter turn, which brings the points of contact upon new fuses.

To use as a switch, it is only necessary to give the handle a one-eighth turn and the points of contact are carried from the metal tips of the fuse holders to the porcelain rotating fuse block, thus effecting complete insulation. When it is desired to turn on the current another one-eighth turn brings the points of contact again upon new fuses and the lights burn.

These switches are made both in single and double pole, and possess so many advantages as to warmly commend them to all users of switches and fuses.

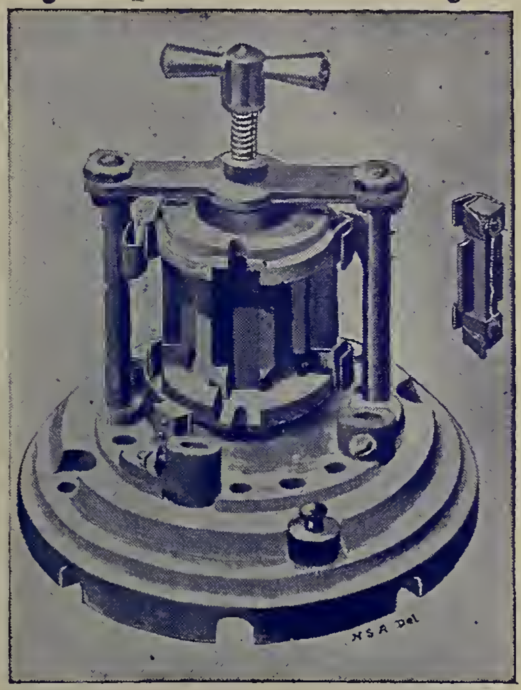


DYNAMO ROOM OF THE BUCKEYE ELECTRIC CO., CLEVELAND.

The ease and rapidity with which the blown fuses are replaced removes all temptation from a careless engineer to put in fuses heavier than the line should be supplied with, thereby not jeopardizing the insurance of the owners of the building.

Electricians and insurance men who have critically examined, tested and used the multifuse switch, unanimously speak of it in the highest terms; and it meets with commendation from all sides, owing to the great protection it affords, the amount of time it saves and the knowledge that a magazine of fuses ready to be instantly used is at hand.

The Multifuse Switch Company, 1031 Society for Savings



MULTIFUSE SWITCH.

Building, Cleveland, Ohio, is the manufacturer of this device.

The question of organizing and building an electric railroad in Northport, L. I., is being agitated.

Wm A. Strauson, Northport, L. I., is at the head of a scheme to construct a telephone system in that vicinity.

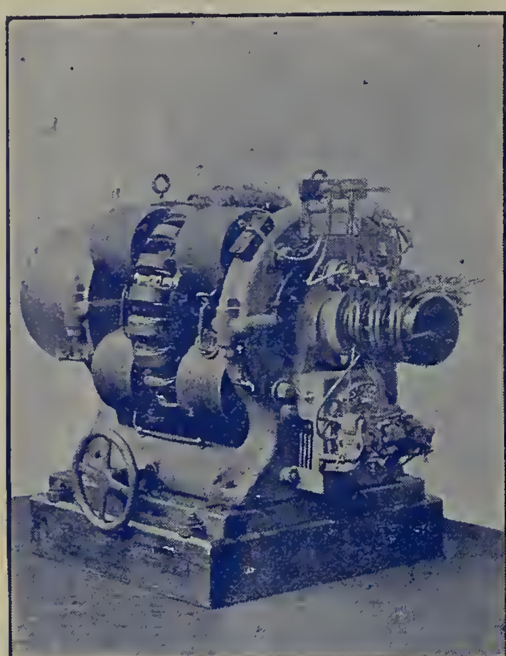
The Frank C. Patton Mfg. Co., of Sycamore, Ill., has been granted a franchise to build an electric light plant in that place.

W. A. Heller and A. E. Swartz, of the new traction company of Allentown, Pa., have made application for permission to lay tracks in Kutztown. A car and power-house will probably be erected in the latter place.

(*Continued from page 108.*)

cal inventions, Mr. Francisco at once adopted his usual method of procedure and made a thorough study of the subject of electricity as applied to lighting and power purposes.

In the fall of 1887 he became a member of the National Electric Light Association, and has since held many positions of honor in the association. At the convention in Kansas City he was elected one of the executive committee, holding that position until the Providence convention, when he was made second vice-president, and at the

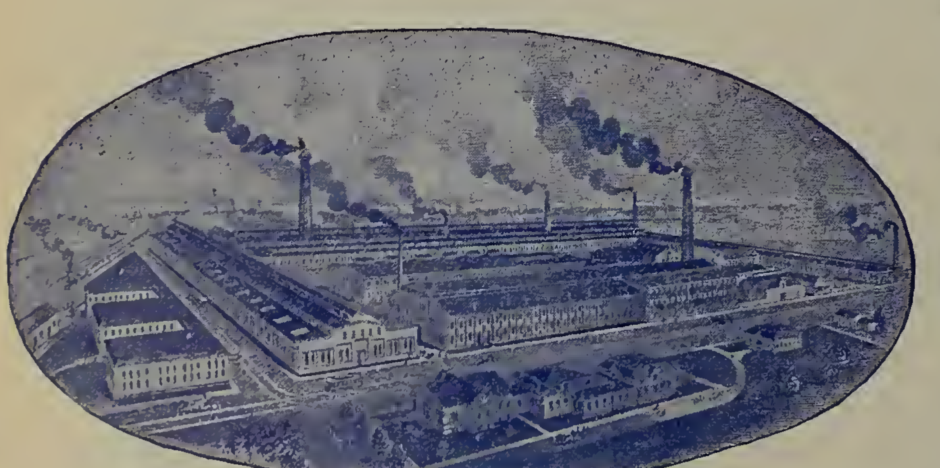


BRUSH 10 LIGHT ARC DYNAMO.

St. Louis convention was elected first vice-president. Between the different conventions his efforts have been given in behalf of the various committees of which he was chairman, the more important of which were the committee on formulating the revised constitution of the National Association, the committee on underground wires and conduits, and as a member of the committee for harmonizing the electrical and insurance interests.

Mr. Francisco's position regarding municipal ownership of electric light plants is well known. He was called before the Joint Committee of the Massachusetts Legislature and there made an able argument in opposition to the bill for municipal ownership.

He has received calls from nearly every state in the Union, for information regarding the "fallacy of municipal



VIEW OF BRUSH ELECTRIC CO'S WORKS, CLEVELAND, OHIO.

ownership," and is now acknowledged the best authority of the day upon this problem.

Mr. Francisco is one of the most prominent citizens of Rutland, Vt., and is president and general manager of the Rutland Electric Light Company, director of the Rutland Trust Company, member of the Rutland Board of Trade, and of the Rutland County Association of Underwriters, and of the Institute of Electrical Engineers of America, and a stockholder in a large number of local concerns of the city.

THE BRUSH ELECTRIC CO.

The Brush Electric Co., of Cleveland, hardly needs any introduction to the electric light fraternity, it is so well known. The Brush Company was the first organized for carrying on the business of arc-lighting, and the dynamos and generators are among the most efficient types manufactured.

The works of the company, of which an illustration is given herewith, cover an area of about seven acres. They are located at the corner of Belden and Mason streets, adjoining the tracks of the Cleveland & Pittsburgh Railroad. The main machine shop is 264 feet by 120 feet, and is fully equipped with the most modern machinery. There are about 350 machines in this department, and when they are all in motion and attended by workmen, it is an interesting and inspiring sight. Travelling electric cranes move about the building carrying heavy machinery in every direction. These cranes are operated from a street railway circuit of 500 volts. The machine shop is lighted by arc and incandescent lamps. The testing-room is also on this floor and is equipped with all the latest and improved apparatus for this particular department of the immense industry. The engine and boiler-rooms are located at the rear of the machine shop. There are two 200-h. p. Wright engines and two Ball & Wood cross-compound engines.

The general offices of the company are located near the works, in a handsome little two-story building.

We give an illustration of the company's No. 10 arc dynamo of the latest design. This machine, as will be noticed, is very compactly and solidly built. It occupies very little floor space, and is in every way an excellent example of the highly efficient machines produced by this company. It is constructed according to the latest designs and is provided with every adjunct necessary to insure mechanical and electrical perfection.

THE NATIONAL UNDERGROUND CONDUIT SYSTEM.

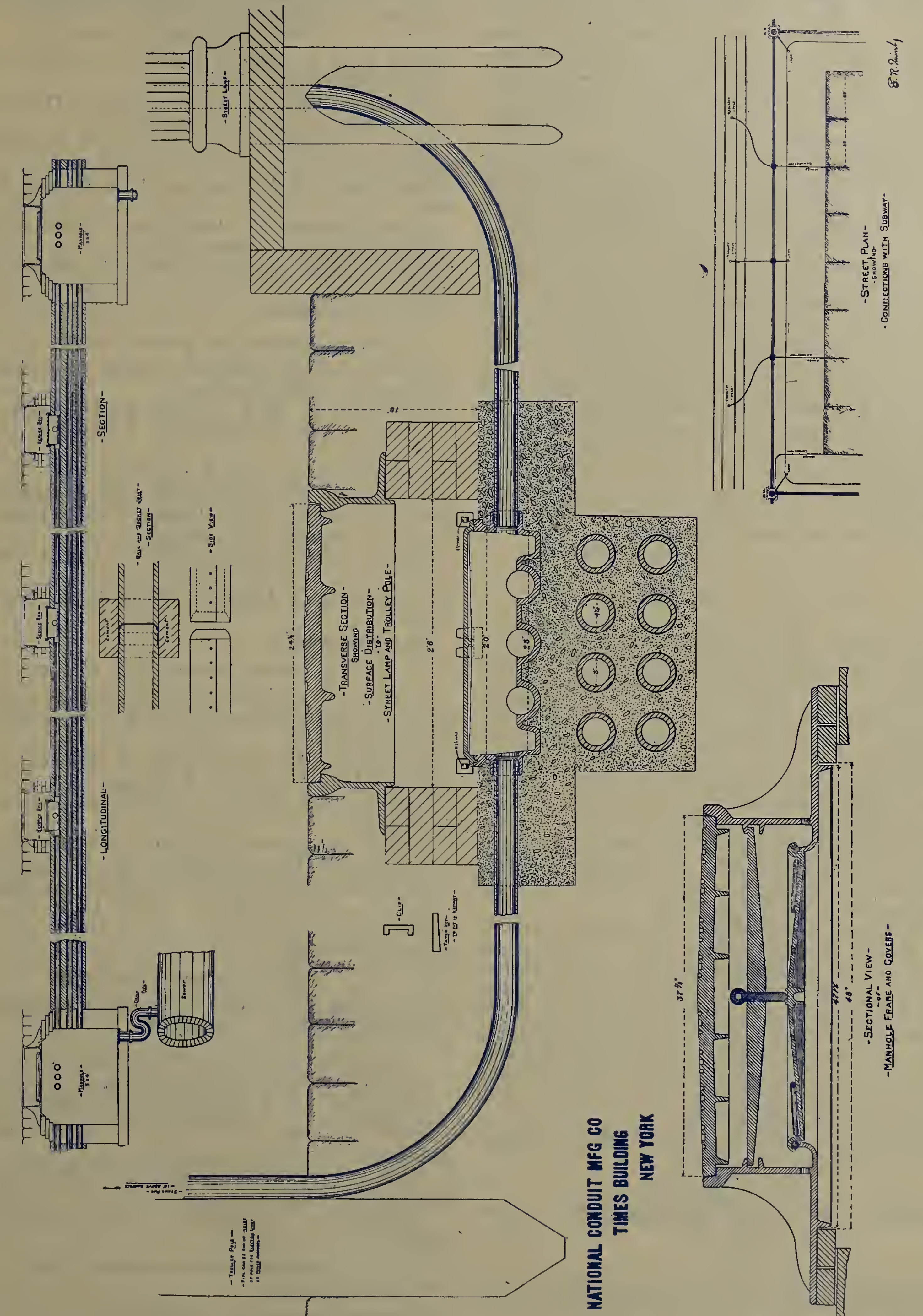
Now that an underground subway is as necessary to the successful operation of all electric plants, of both high and low tension currents, as a pipe line is to a gas or water company, from the simple fact that the cost of maintenance must be kept down to the lowest possible notch to enable the various companies to become and remain dividend payers, and as overhead lines are so enormously expensive to maintain, the natural inquiry of all those who are interested in this new and far reaching field of electricity is—What is the safest and most economical system, by which they can accomplish the burying of their wires, and at the same time, have them so placed and arranged that they can be tapped for street lamps and house service?

The National Conduit Manufacturing Company, New York, seems to offer one of the most complete and workmanlike systems that could be devised, as shown by the illustrations herewith. Their mode of accomplishing the result is very simple.

In the first place—assume for example—that the requirements are a subway consisting of eleven ducts or tubes. They construct the manholes at about four hundred feet apart, of course preferably at the intersecting streets; then in the trench, which connects these manholes, they lay their well known wrought iron cement lined tubes. In a system of this size, they would place it in two layers of four each, these being massed in a matrix of broken stone, sand and cement concrete, making a system of continuous tubes from manhole to manhole. These tubes would be used for the main or trunk feeders. On top of these two layers they then place a third layer of three tubes.

Intersecting this layer of tubes at intervals of, say, every fifty feet, or in other words, at every alternate house line, a specially designed cast iron box is placed, which has a removable cover, which when secured is water-tight.

These boxes have side outlets, which can be extended to the house or street lights, along the line, as we will later on describe. The bottoms of the boxes are arranged to conform to the lower half of the tubes intersected, thus making a continuous channel for the rodding and drawing in of the cables from manhole to manhole. These boxes being about 18 inches below the surface of the street they are compelled of necessity to construct a small chamber, preferably of brick, and on top of the brick work they place a heavy casting like a manhole cover, only smaller, which also has a removable cover. This gives a complete system from manhole to manhole, which can be extended to any distance, and the number of tubes can be varied to suit the requirements of the station. By placing the box at alternate party lines enables the company to reach both houses from one box, and as three tubes are all that will ever be required for distribution in any one block, it is unnecssary to use more than this number in the top course. The main trunk cable is tapped in the manhole, where ample room is provided, and a smaller branch cable is drawn through the tube or distributing tubes and boxes, and when necessary to make a connection for house or street light service the cover adjacent to the building or lamp is removed; then the cover of the intersecting or distributing box is removed, thus allowing access to the cables lying in the distributing ducts and boxes. A connection is made



SECTIONAL VIEW OF THE NATIONAL CONDUIT MFG. CO.'S SYSTEM OF UNDERGROUND DISTRIBUTION.

to the cellar of the building or the base of street fixture, by means of a wrought-iron tube connecting with the side outlet of the distributing box. Into this tube a branch cable is drawn and connected in the usual way to the distributing cable, confined in the box, and connecting tubes; then the covers are replaced, and the subway is again intact.

The system, as above described, is in hundreds of cases in practical use in many of the large cities of this country.

In this connection we would mention the Allegheny County Light Company, Chicago Edison Company, the Brush Electric Light Company of Buffalo, all of whom can testify to the convenience of the system.

The National Conduit Manufacturing Company have constructed and furnished the material for the subways for almost all of the companies who have done any work of this description throughout the United States and Canada. Many of the various Edison Companies are now figuring with them to replace the old three-wire system with a drawing-in system, such as we have just described. Their business has increased enormously in the past five years, so much so that they are now making extensive alterations and improvements at their works, which will more than double their output; and when we say that during the year 1894 they furnished over four millions of feet, and their gross business amounted to over one million of dollars, it certainly demonstates the facts that the efforts put forward by this company have been understood and appreciated. They are now putting themselves in line for a very large output and increased business, as their aim always seems to be to fill all their contracts within the time specified by them.

CHARLES F. BRUSH.

Among Cleveland's most prominent citizens none is better known than Mr. Chas. F. Brush, the pioneer in electric arc lighting. Mr. Brush lives in an elegant stone house on Euclid avenue. His residence is equipped with every modern convenience, including, of course electric lights.

Mr. Brush was born in Euclid township, near Cleveland, on March 7, 1843. He spent the early part of his life upon a farm and afterwards attended the public schools of Cleveland. In 1866 he entered the University of Michigan and was graduated three years later with the degree of mining engineer. He returned to Cleveland and opened an office as an analytical chemist. He devoted his attention to this profession for three years, and four years afterwards was engaged in the iron business

In 1875 his attention was attracted by the experiments in electric lighting in Paris and London. He afterwards invented the celebrated Brush dynamo, and in order to make the electric lighting system complete, a lamp had to be invented, which Mr. Brush proceeded to do. The Brush lamp is today substantially the same in form and principle as the first one produced. Within a year, both dynamo and lamp were in working order and ready to be put upon the market, and what success they have made is well known to every one of our readers.

Mr. Brush possesses a vast fund of scientific knowledge and is besides very practical.

PROGRAMME OF THE CLEVELAND CONVENTION.

The following is a copy of the official programme of the meeting of the National Electric Light Association, to be held in Cleveland, O., February 19, 20 and 21 :

TUESDAY, FEBRUARY 19, 1895.

Meeting of the Executive Committee at 9 A. M., Parlor 138, Hollenden Hotel.

MORNING SESSION—10:30 O'CLOCK—ARMY AND NAVY HALL.

Address of Welcome by the Mayor of Cleveland.
President Francisco's Address.
Paper by N. W. Perry: "The Storage of Energy Essential to Central Station Economy; How It May be Accomplished and the Economies Resulting."
Discussion. John W. Langley, W. M. Stine, M. J. Perry.
Report of Committee on Relations Between Manufacturing and Central Station Companies. Frederic Nicholls, chairman.

AFTERNOON SESSION—2 O'CLOCK.

Paper by E J. Houston and A. E. Kennelly: "A New Method of Measuring Illumination."
Discussion. W. A. Anthony, C. D. Haskins, W. S. Howell, Edward Weston, L. Stieringer.
Report of Committee on Data. H. M. Swetland, chairman.
Discussion. W. R. Gardener, E. L. Powers, H. W. Sexton.
Paper by Walter E. Harrington: "Correct Method of Protecting Electric Circuits."
Questions and Answers. What Is It You Wish to Know?
Executive Session.

WEDNESDAY, FEBRUARY 20—MORNING SESSION, 10 O'CLOCK.

Paper by Edward Weston: "Some Economies in Electric Light and Power Stations."
Paper by C. N. Black: "Large Arc Dynamos."
Discussion. S. M. Hamill, J. J. Wood, F. W. Rollins, E. R. Weeks.
Topic: How to Light Large Cities.
Discussion. Frederic Nicholls, Geo. A. Redman, Jas. I. Ayer, E. F. Peck, C. R. Huntley, Robert Lindsay, F. H. Clark, T. C. Smith, J. F. Morrison.
Report of Committee on Finance. John A. Seely, chairman.
Questions and Answers. What Is It You Wish to Know?
Executive Session.

AFTERNOON SESSION—2:30 O'CLOCK.

Paper by E. A. Leslie: "The Operation of High Tension Currents Underground from a Physical and Financial Standpoint."
Discussion. H. J. Smith, W. H. Browne, C. H. Wilmerding, John A. Seely, C. L. Edgar.
Paper by L. B. Marks: "Arc Carbons and the Rating of Arc Lamps."
Topic: Incandescent Lighting vs. Other Methods.
Discussion. H. T. Edgar, E. F. Phillips, W. S. Barstow, E. A. Armstrong, J. Gwynn, B. P. Holmes.
Questions and Answers. What Is It You Wish to Know?
Executive Session.

EVENING SESSION—8 O'CLOCK.

Topic. -By A J. Wurtz: "Practical Demonstrations of Protecting Lines from Lighting."

THURSDAY, FEBRUARY 21—MORNING SESSION, 10 O'CLOCK.

Paper by Dr. Louis Bell: "The Monocyclic System."
Discussion. A. E. Kennelly, L. B. Stillwell, J. F. Kelly.
Report of Committee on Rules for Safe Wiring. Wm. J. Hammer, chairman.
Topic: Underwriters' Rules vs. National Electric Light Association Rules.
Discussion. Wm. Brophy, C. H. J. Woodbury, J. J. Burleigh, A. W. Field.

AFTERNOON SESSION—2:30 O'CLOCK.

Executive Session.
Report of Secretary and Treasurer.
Executive Committee.
Election of Officers.

The San Antonio Electric Co., San Antonio, Texas, by R. T. McDonald, Ed. J. O'Bierne and Wm. H. McGraw. Capital stock, $100,000.

The Clarksville Telephone Co., Clarksville, Tenn., by F. P. Gracey, D. N. Kennedy, B. H. Owens and others.

PRINCIPLES OF DYNAMO DESIGN.

BY

Newton Harrison E.E.

(*Continued from Page 97.*)

The curve which represents most graphically a complete reversal of magnetization, also delineates the variety and extent of the changes undergone by the sample tested. (Fig. 22).

It always encloses a certain area, which means as much to the investigator as the indicator card does to the engineer. When the bar of iron is brought to a point of saturation and the magnetizing force gradually removed, it

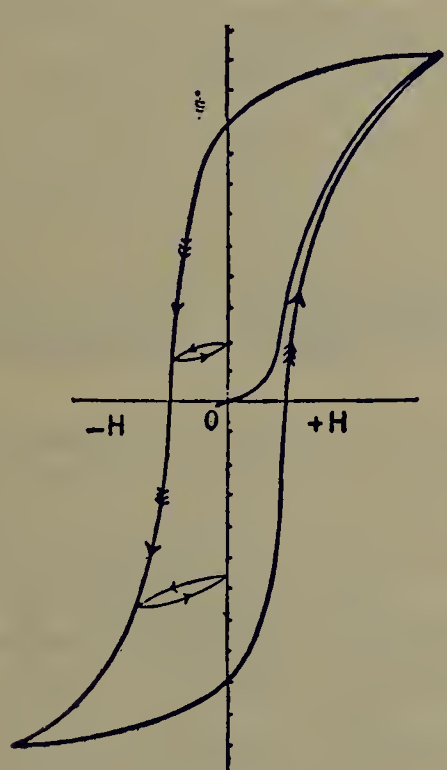


FIG. 22.

will be interesting to observe the formation of loops in the enclosed area of the curve if the following process be carried out:

At any point to which the iron has been demagnetized let the process be temporarily reversed and the iron receive a slight additional magneto-motive force. This will raise the induction slightly by a definite amount. Then reverse again and fall back to the point originally started from; it will be then noted that the rise and fall of magneto-motive force has produced a small loop in the diagram.

This loop merely represents the value of the increase of energy necessitated by bringing the iron from a point of induction B to a higher induction B' and back again to B.

The residual magnetization in all cases is directly due to the remarkable effects of the coercive force. In the curve given the value $O\,E$ represents the "residual magnetism" or "retentiveness" of the iron. (Fig. 23).

On the indicator card of a steam-engine the curve represents the gradual expansion of the steam and its transformation into work in the cylinder of the engine, covering the whole cycle of operations.

In the curve of hysteresis the entire cycle of magnetic effects is likewise shown and the enclosed area is a measure of the energy turned into heat in the iron.

The energy wasted by reversals may be calculated from the area of the curve, because the watts wasted are equal to the area of the cyclic curve multiplied by the volume of the iron in cubic centimeters and by the number of cycles per minute then divided by 7,500,000,000, according to Dugald Jackson

Or watts wasted =

$$\frac{\text{area of curve} \times \text{volume iron} \times \text{cycles per minute}}{7,500,000,000}$$

A knowledge of the increase of temperature due to the waste of energy in the iron is of great importance to the designer in order that the proper allowances may be made for the same.

According to the experiments of Joule a rise in temperature of about .000284° Centigrade in a cubic centimeter of iron undergoing a double reversal of magnetization and dissipating about 10,000 ergs would be experienced if the heat were completely retained. Therefore, if the iron is heated 1° Centig., it would require about 4,000 reversals to reach that temperature above the surrounding air.

The value of the above in English units would mean a rise of .000158° F. per cubic inch of iron under the same conditions.

As a watt = 10,000,000 ergs, it is very easy to pass from the absolute to the practical system of units. Therefore a cubic inch of iron equalling 15,625 cu. cms. would expend 156,250 ergs or about 156,250 ÷ 10^7 = .016 watts per cubic inch to cause a rise in temperature of .000158° Fahr. throughout the mass.

Prof. Ewing has given the energy expended in ergs per cubic centimeter for a complete cycle of magnetization.

Sample of iron operated upon.	Energy dissipated in ergs per cubic centimeter during a complete cycle of doubly reversed strong magnetization.
Very soft annealed iron	9,300 ergs.
Less " "	16,300 "
Hard drawn steel wire	60,000 "
Annealed steel wire	70,500 "
Same steel, glass hard	76,000 "
Pianoforte steel wire, normal temper	116,000 "
Same annealed	94,000 "
Same, glass hard	117,000 "

Fleming averages about 28 foot-pounds per cubic foot

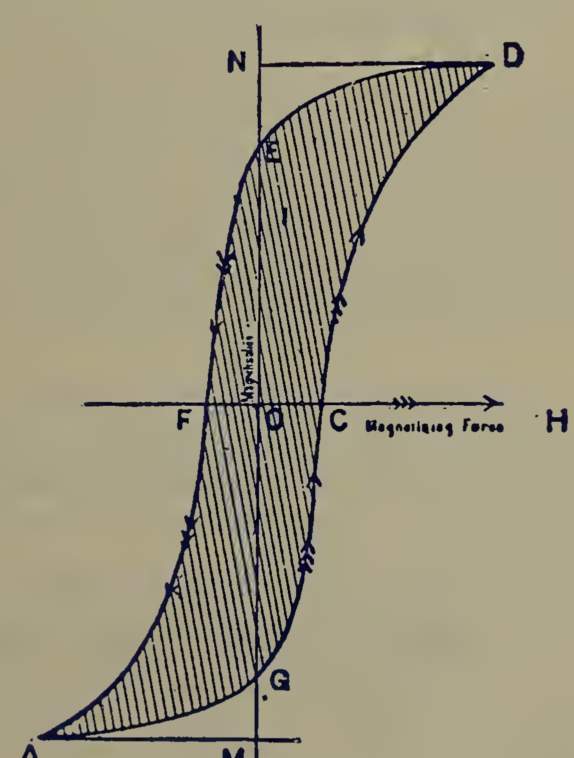


FIG. 23.

to make a double reversal of strong magnetization in soft iron.

It is a peculiar fact to learn that if iron is kept in a state of vibration while undergoing rapid reversals of magnetization the hysteresis is very much less than otherwise. This continual shock to the iron has the effect of shaking the molecules into their normal position and therefore diminishing the effects of the retentivity of the iron to a very great extent.

(*To be Continued.*)

THE POWER PLANT OF THE BALTIMORE AND OHIO BELT LINE TUNNEL.

Probably no electric plant, or we might say, electric experiment on a large scale, has attracted more attention than the Baltimore and Ohio Railroad Tunnel plant in Baltimore, which will decide beyond dispute the question as to whether electric traction is adaptable to steam railways as a substitute for steam locomotives, and also as to whether electricity is the best motive power for rapid transit in tunnel plants.

The Belt Line Road, as it is termed, is but a short cut connecting the main tracks of the Baltimore and Ohio Railroad at two points, and its object is to avoid a long curve about the city. This is calculated to save from twenty minutes to half an hour in the running time between New York and Washington, and besides it will enable the Baltimore and Ohio Railroad Company to place one station near the present Union Station of the Pennsylvania Railroad, and a second one in the very heart of the business centre of the city.

The Belt Line Road is about seven miles long. It begins near Bayview, to the East of the city, runs several miles through deep cuts along the northern edge of the city until it swerves around to the Jones Falls embankment, west of Oak street; it crosses the valley of this stream the tracks of the Pennsylvania Railroad, and the Baltimore and Lehigh Railroad on a large bridge, and a short distance beyond this it enters the tunnel, which follows Howard street, through the city to the present Camden station.

The tunnel is 7,430 feet, a little less than a mile and a half long, and it cost the Baltimore and Ohio Railroad Company, between $7,000,000 and $8,000,000.

The motive power is furnished from one station located near the end of the tunnel. This power house is equipped throughout by the General Electric Company, who is making the test of electric traction at its own expense, and if it proves in every way successful, the Baltimore and Ohio Railroad Company will purchase the plant complete.

In addition to the traction plant an electric lighting plant is found here which will supply about 2,000 incandescent lamps, placed throughout the tunnel. As there will be no smoke in the tunnel, it is intended to paint its interior white, and when illuminated by the electric lights it will not be necessary to light the lamps in the car of passing trains, as the passengers will find it almost as brilliant inside the tunnel as outside in the daylight.

The generators will be driven by Armington & Sims engines, and the steam will be furnished from improved "Root" Water-Tube Boilers. The boiler room of this plant is most interesting and includes the most modern appliances.

Twelve "Root" boilers are found arranged in six batteries; three batteries on each side of the room. Each of the two flues, which run along the opposite walls back of the boilers, carry the heated gases to economizers, which rob the gases of their heat, and by this means raise the temperature of the feed water.

The gases then pass into a fan of the Sturtevant pressure pattern, which expels them through a short stack into the air. This fan establishes an induced draft, causing the air to pass rapidly through the grate bars and coal, thus promoting combustion more or less rapid, according to the speed of the fan, which is regulated by the demand for steam on the plant.

A coal and ash handling device, made by the C. W. Hunt Company, carries the coal direct to each of the boilers, where it is needed, and it also carries the ashes away from the ash pits

As the General Electric Company is relying entirely upon the success of this plant for the sale of it to the Baltimore and Ohio Railroad Company, it naturally was obliged to exercise the greatest care in the selection of all the appliances. To illustrate this point, in the case of the boilers, the company did not place the order with the manufacturers until after it had thoroughly tested them in two of its plants in Lynn, Mass., which are equipped with this make of boilers.

THE STANDARD UNDERGROUND'S OFFER.

The Standard Underground Cable Company, of Pittsburgh, offers to convention delegates to lay bare, on request in writing or otherwise, the vast amount of valuable information gathered by them during their twelve years of successful manufacture and installation of underground plants. The company manufactures cables for all purposes, but makes the above offer especially as to electric light cables.

FAMILIAR FACES AT THE CONVENTION.

The Okonite Company, Limited, will be ably represented at the Convention by Capt. Willard L. Candee and George T. Manson, without whom, no gathering of the electrical fraternity would seem quite complete.

The Abendroth & Root Manufacturing Co., 28 Cliff street, New York city, are the sole makers of the Root Improved Water-Tube Boiler so generally employed nowadays in electric lighting and street railway power stations. It has branch offices in the Perin Building, Cincinnati, Ohio, Monadnock Building, Chicago, Ill., Security Building, St. Louis, Mo, and at No. 8 Oliver street, Boston, Mass. The company will be represented at the Convention by Mr. P. M. McLaren, and those of the electrical fraternity desirous of becoming better acquainted with the merit of the Root boiler for this special class of work, will find him ready at all times to aid them in the matter.

THE VAN DORN IRON WORKS.

This concern, which is one of the foremost of its kind in Cleveland, enjoys a large trade with electric light and electric railway companies. The works are completely equipped with the most modern machinery for general contracting work in the higher grades of iron and steel for all purposes. Among the company's specialties are poles for electric railways. They recently completed a large contract for the Cleveland Electric Railway Company of 200 car-vestibules, which were gotten up with a view of obtaining the best results. This vestibule has fully justified the company's expectations and those of the people, and fully fills the requirements of the Ohio state law which was passed two years ago.

Fencing for railroad companies constitutes another of the Van Dorn Iron Works specialties.

The company is progressive and is constantly developing new things.

Mr. J. H. Van Dorn is the president of the Van Dorn Iron Works, and D. B. Van Dorn, superintendent. The company's office and salesrooms are at Madison avenue and Nickel Plate R. R.

THE INCANDESCENT LAMP OF TODAY*

BY JOHANNES H. CUNTZ.

Lamps are made of all sizes, from 100 candle-power and over down to ½ candle-power, but the small ones are decidedly the most interesting and picturesque. At the large factory of which we have spoken, there is a special department devoted to decorative and miniature lamps, of all shapes and colors, curious and beautiful. There are "candelabra" lamps, much used for lighting private residences and which are generally of 10 candle-power. Some of them are pear-shaped, while others are long and tapering and of an extremely graceful form. They are often fitted to receptacles concealed in imitation candles, and while they have all the warmth and elegance of the old-fashioned wax tapers, they give a far steadier and brighter light. One of the most striking styles is the "flame" lamp, which is a narrow cone of glass, twisted spirally and frosted; it has the beauties of a brightly burning flame, with none of the drawbacks.

* From *Cassier's Magazine.*

There is the eight candle-power "kinetoscope" lamp, which illuminates the photographs on the rapidly moving celluloid strip in Edison's remarkable picture gallery. A one candle-power lamp is used for night work in telephone exchanges. One is placed in each panel of the switchboard and lights up whenever a call comes to its territory, and stays lighted until the call is answered, so that one or two operators can easily manage all the night business wherever it is not very heavy.

Telephone Notes.

TELEPHONE PATENTS ISSUED FEBRUARY 5, 1895.

AUTOMATIC TELEPHONE SWITCH. Henry D. Bayne, Brooklyn, N. Y. (No. 533,427).

TELEPHONE ARM-REST AND RECEIVER-HOLDER. William Steubing, Cincinnati, O. (No. 533,619).

TELEPHONE OR ANALOGOUS ELECTRODE. Thomas McCoubray, New York. (No. 533,729).

TELEPHONE EXCHANGE. Morgan Brooks, Minneapolis, Minn. (No. 533,785).

Possible Contracts.

The South-Western Telephone and Telegraph Co, has been granted a franchise to establish a telephone exchange in Taylor, Tex.

Wells Bros., Smithville, Ga., can give information regarding a proposed electric light plant.

The Edison Electric Light Co., Boston, Mass., proposes to erect a four-story building for the accommodation of a storage battery plant.

The City Clerk of Sabetha, Kansas, can give information regarding the proposed establishment of an electric light plant in that place.

The Johnstown Telephone Co., Johnstown, Pa., has been organized for business.

It is reported that Messrs. Tucker, Anthony & Co., Boston, Mass., have purchased the Consolidated Street Railway Co., of Macon, Ga., for $450,000.

It is reported that a large generating plant will be erected in Readsboro, Vt., by the General Electric Company.

A telephone franchise has been granted a local company in Marseilles, Ill.

The Harrison Telephone Co. has asked for a franchise to establish a plant in Richmond, Ind.

New Corporations.

The Anderson Telephone Co., Anderson, S. C., by R. E. Ligon, L. P. Brock, and J. L. Maulding.

The Valdosta Telephone and Telegraph Co., by J. D. Whilaw and others.

A company is being organized in New London, Conn., to build an electric railroad between New London and Norwich. Capital stock, $200,000.

American District Telegraph Co., Omaha, Neb., by W. H. Wakefield, C W. Coker, A. A. Clark, W. D. Hardin, Fred. Davis, W. C. James and Emmet Tinley.

The Las Vegas Water and Electric and Power Co., Santa Fé, N. M., by F. A. Manzanares, M. W. Browne, J. S. Duncan and John I. Pace.

Electric Light Photograph Co., Chicago, Ill., by Oscar L. Sturtz, Robert E. Brown and Chris. Florup. Capital stock, $5,000.

The Western Telephone Co., Atchison, Kan., by F. M. Baker, J. W. Sharrard, M. J. Traverse, R. A. Miller and E. D. Mills. Capital stock, $10,000.

Trade Notes.

The Improved "Fishkill-Corliss engine built by the Fishkill Landing Machine Co., Fishkill-on-the-Hudson, N. Y., is especially well adapted to situations where close regulation and noiseless operation is desirable, and on this account finds a ready demand for electric lighting and power plants. Representing in its construction the highest development in the "Corliss" type of engine, it has the endorsement of the leading manufacturers and corporations in the United States.

Those interested in the economical handling of coal and ashes in electric lighting and power stations, should make application to the C. W. Hunt Co., 45 Broadway, New York city, for a copy of its finely illustrated catalogue, "Coal Handling in Power Stations." The Hunt Company has been eminently successful in the equipment of lighting and power stations with coal handling machinery, and is generally regarded as the leaders in this class of work.

WOVEN WIRE BRUSHES.

The Belknap Motor Co., of Portland, Maine, are the patentees and manufacturers of the best woven wire commutator brush on the market.

Electrical and Street Railway Patents.

Issued February 12, 1895.

533,861. Electric Locomotive. Eben M. Boynton, West Newbury, Mass. Filed Apr. 9, 1894.

533,869 Conduit System for Electric Railways. Frederick S. Davenport, Jerseyville, Ill. Filed Oct. 26, 1894.

533,873. Alternating-Current Dynamo-Electric Machine. Axel Ekstrom, Lynn, assignor to the General Electric Company, Boston, Mass. Filed July 26, 1894.

533,885. Apparatus for Winding Armature-Coils. Henry Geisenhöner, Schenectady, N. Y., assignor to the Thomson-Houston Electric Company, same place. Filed Aug. 22, 1894.

533,893. Electrical Exchange System. George W. Hey and Arthur E. Parsons, Syracuse, N. Y. Filed Mar. 30, 1893.

533,900. Anti-friction Device for Car-Trucks. Moses G. Hubbard, Chicago, Ill. Filed July 25, 1893.

533,902. Electrically-Operated Recording Instrument for Compasses. Charles L. Jaeger, Maywood, N. J. Filed Jan. 25, 1894.

533,905. Distribution System for Electric Railways. Walter H. Knight, Schenectady, N. Y., assignor to the Thomson-Houston Electric Company, Boston, Mass. Filed Nov. 30, 1894.

533,910. Tip for Electric Conductors. Amandus Metzger, Schenectady, N. Y., assignor to the Thomson-Houston Electric Company, Boston, Mass. Filed Nov. 26, 1894.

533,913. Fuse-Block and Socket. Frederick W. Mount, St. John, Canada. Filed July 16, 1894.

533,916. Car-Fender. Adolfo Pierra, Philadelphia, Pa. Filed Nov. 2, 1894.

533,926. Electric Automatic Block-System Signal. Joseph B. Stewart, Haverstraw, N. Y. Filed Mar. 8, 1894.

533,930. Armature-Winding. David P. Thomson, Schenectady, N. Y., assignor to the General Electric Company, Boston, Mass. Filed Aug. 4, 1894

533,931. Dynamo-Electric Machine. Elihu Thomson, Swampscott, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Dec. 29, 1894.

533,932. Carbon for Arc Lamps. Elihu Thomson, Swampscott, assignor to the Thomson-Houston Electric Company, Boston, Mass. Filed Nov. 26. 1894.

533,961. Life-Saving Guard for Cars. Giovanni Mauro and Francesco Renzo, Paterson, N. J. Filed Nov. 5, 1894.

533,967. Combined Telephonic and Telegraphic System. Christopher A. Shea, Boston, assignor of one-third to Freeborn F. Raymond, 2d, Newton, Mass. Filed July 30, 1892.

533,969. Car-Fender. Charles W. Stringham, Brooklyn, N. Y., assignor, by direct and Mesne assignments, of five-sixths to George H. Thomson and John A. Williams, same place, and John H. Faulstich, Frederick Hausmann and George Kraus, New York, N. Y. Filed Feb. 3, 1894.

533,979. Electrical Time-Alarm. Walther Wilke, Wermelskirchen, Germany. Filed Aug. 7, 1894.

534,028. Electric Railroad-Switch. Rollin A. Baldwin, South Norwalk, Conn., assignor to the Fitch Excelsior Switch Company, of New Jersey. Filed June 27, 1893.

534,036. Galvanic Battery. Warren P. Freeman, Brooklyn, N. Y., assignor to the Newton Rubber Works, Newton, Mass. Filed June 11, 1894.

534,038. Dynamo-Electric Machine. Rodolphus Fuller, Detroit, Mich. Filed Oct. 20, 1894.

534,060. Electric Controller. George F. Card, Covington, Ky., assignor to the Card Electric Company, Mansfield, Ohio. Filed May 17, 1894.

534,078. Regulating Device for Car-Motors or Other Electrical Apparatus. Horace F. Parshall, Schenectady, assignor to the Edison General Electric Company, New York, N. Y. Filed Dec. 11, 1891.

534,079. Armature for Dynamo-Electric Machines. Horace F. Parshall, Schenectady, assignor to the Edison General Electric Company, New York, N. Y. Filed Feb. 20, 1892.

534,083. Telephone Metallic Circuit. Christopher A. Shea, Boston, assignor of one-third to Freeborn F. Raymond, 2d, Newton, Mass. Filed July 30, 1892.

534,084. Combined Telephone and Telegraph System. Christopher A. Shea, Boston, assignor of one-third to Freeborn F. Raymond, 2d, Newton, Mass. Filed July 30, 1892.

534,085. Telephone Metallic Circuit. Christopher A. Shea, assignor of one-third to Freeborn F. Raymond, 2d, New ton, Mass. Filed July 30, 1892.

534,086. Electric-Arc Lamp. Thomas Spencer, Philadelphia, Pa. Filed June 6, 1894.

534,092. Means for Mounting Dynamos on Railway-Cars. William Biddle, Brooklyn, assignor to the American Railway Electric Light Company, New York, N. Y. Filed May 23, 1894.

534,114. Fender for Street-Cars. Gustave Lundberg and Charles H. Mattice, West Troy, N. Y. Filed Nov. 1, 1894.

534,151. Alternating-Current Motor. Robert H. Hassler, Pittsburgh, Pa., assignor to the Westinghouse Electric and Manufacturing Company, same place. Filed Nov. 30, 1894.

534,206. Filament for Incandescent Lamps. Thomas A. Edison, Menlo Park, N. J. Filed Jan. 4, 1884.

534,208. Induction-Converter. Thomas A. Edison, Llewellyn Park, N. J. Filed May 21, 1888.

534,209. Incandescent Electric Lamp. Thomas A. Edison, Llewellyn Park, N. J. Filed Sept. 17, 1890.

534,218. Safety Attachment for Street-Cars. Albert E. Hughes, Darien, Conn. Filed Mar. 2, 1894.

534,238. Supply System for Electric Railways. Malone Wheless, Washington, D. C., assignor to the Electro-Magnetic Traction Company, same place. Filed Dec. 3, 1894.

ELECTRICAL AGE

VOL. XV., No. 9. NEW YORK, MARCH 2, 1895. WHOLE No. 407

ESTABLISHED 1883.

Entered at New York P. O. as second-class matter, January 18, 1891.

THE ELECTRICAL AGE PUBLISHING CO., PUBLISHER

TERMS OF SUBSCRIPTION :

One Copy, one year,	$3.00
One Copy, six months,	1.50
Great Britain and other Countries,	4.00

Cable Address (all Cables,) "Electage," New York.

W. T. HUNT, President F. N. BASSETT, Vice-President.
T. R. TALTAVALL, Secretary and Editor.
NEWTON HARRISON, E. E., Scientific Editor.

ADDRESS ALL COMMUNICATIONS TO

THE ELECTRICAL AGE PUBLISHING COMPANY,

FIRST FLOOR, WORLD BUILDING.

NEW YORK.

NEW YORK, MARCH 2, 1895.

CONTENTS.

OUR BOW TO PRESIDENT WILMERDING.

In our last issue we stated prophetically that the new president of the National Electric Light Association was a man of integrity and ability. We now claim the honor of being more accurate prognosticators than Uncle Sam's stipendiaries in their efforts to tell us what kind of weather we shall have on the morrow. Mr. C. H. Wilmerding fits our description perfectly, and we congratulate him on the occasion of his election to the presidency of the association. He is a worthy successor to his worthy predecessor.

SHINING LIGHTS.

Quite an array of electrical giants was that at Cleveland last week! Beginning with Brush, there was Thomson and Houston, Kennelly and Steinmetz, and many other notables. It was a very interesting crowd. Had Edison been there the chain would have been complete.

MORE GOOD THINGS TO COME.

We are not able to present in one issue all the papers read at the Convention last week—not even abstracts. Everyone of the papers was worth printing in full, but as many of them were rather voluminous it is quite out of the question to give more than an abstract of each.

THE CONVENTION.

The tenth year of the National Electric Light Association was fittingly recognized in Cleveland last week, when one of the most successful and interesting meetings was held by that association. A decade is generally regarded as a period of time that denotes strength, stability and power; and no one who is at all familiar with the character of this association can gainsay the fact that it possesses these qualities to a large degree. The Electric Light Association is a very useful and desirable organization to electric light people. Once a year all engaged in that great industry have the opportunity to meet in convention and compare notes. The leaders of the profession on these occasions always have something new to describe—the latest developments in the science—and these meetings serve as milestones along the path of progress in electric lighting. The papers read at the convention last week were of the most practical character. One of the liveliest subjects that is at the present time engaging the attention of electric light managers is the question of economy of storage batteries in connection with electric lighting. Mr. Nelson W. Perry read a very able paper on this subject, which, no doubt, will have great influence in favor of the storage battery for such purposes. The paper of Messrs. Houston and Kennelly on the subject of light measurement was also a very practical one, and opens up a way to a fairly satisfactory solution of the difficulties in the way of measuring illumination.

The paper on the "Monocyclic System," by Dr. Louis Bell, was a complete description of that system, and the interest it aroused was evidenced by the discussion which followed. This was one of the most interesting features of the meeting. The report of the committee on data is a valuable addition to the knowledge on the subject of efficiency of electric power. It shows gradual improvement in practice and a nearer approach to the theoretical heat value of coal. The other papers were interesting and valuable, and there can be no question that the meeting was a most profitable one to those interested. The supply men, without whom no convention would be complete, were out in full force. There were plenty of new things to be shown, and they were seen. Trade ought to be lively, for a while at least, after this convention. Altogether it was a good business convention.

CONVENTION OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

Cleveland, Ohio, February 19, 20 and 21.

The 18th meeting of the National Electric Light Association was called to order in Army and Navy Hall at 11 a. m., Tuesday, February 19, by President M. J. Francisco.

Mayor Robt. Blee, of Cleveland, made an address of welcome, and was followed by James H. Hoyt, of Cleveland, who made a few appropriate remarks.

Mr. Charles F. Brush was then introduced. He gave some historical reminiscences of the early days of electric lighting, and referred to the manner in which the electric light was first received in Cleveland.

President Francisco then delivered his address. He referred to the Association's beginnings and its growth up to the present time, its tenth year. The organization today represented the entire continent, from the Atlantic to the Golden Gate and from the Gulf of Mexico to Canada.

The wonderful development of electric lighting was next referred to. Ten years ago there were about 100 central stations; today there are 2,500, representing assets of over $300,000,000, not including 7,500 isolated plants valued at $200,000,000 more. Ten years ago there were few arc lamps; to day there are 500,000. In 1884 an experimental electric railway was started in Cleveland; there are now nearly 1,000 such railways in operation, with 10,000 miles of track, and assets amounting to $600,000,000.

"Electricity," he said, "has converted the thunders of Niagara to the uses of commerce, and will soon send its reverberations over hundreds of miles of wire into distant cities, there to exert its mysterious power for the benefit of the busy toilers in their race for gold."

Referring to the possibilities of future developments, he said:

"May we not see electricity generated without the aid of steam; the Empire State Express flying acoss the country at the rate of 150 miles an hour; our letters mailed in New York in the morning and read at the dinner table on the Pacific slope; the Electric Special, under an arrangement made by our Master of Transportation, may sail over the rugged peaks of the Alleghanies, or the snow-capped summits of the Rocky Mountains, as we speed on our aerial voyage to the San Francisco convention.

"It may be that the time may come," he continued, "when, by pressing a button, the gold for which man has toiled for generations will flow with a current of a thousand amperes."

After giving the "municipal ownership" idea a hit, he referred to the condition of the Association, both as to membership and financially. Both were excellent.

He favored amending the Constitution so as to hold the meetings at a more seasonable time of the year.

Continuing his remarks, Mr. Francisco said:

"The time has arrived when the plan adopted by manufacturers for destroying the business of the local company, by establishing competing plants in places where there is only business sufficient for one, must be abandoned. This has been done with the intention of compelling the local company to either buy them off or see their own business ruined. The infamous scheme of forcing a sale of apparatus for a city plant by representing to city officials that the price charged by local companies is far in excess of the cost if the city owned its plant, needs the search-light thrown upon it by this Association. This is a question of vital importance," he concluded, "to every central station in the United States, for sooner or later their own business will be attacked, and it may be through the influence of the very manufacturers whose apparatus they are using."

The meeting then adjourned until afternoon.

At the afternoon session Mr. Nelson W. Perry read a paper on "The Storage of Energy Essential to Central Station Economy."

The paper was discussed by W. M. Stine, of Chicago; Herbert Lloyd of Philadelphia, Messrs. Wright, Nichols and others.

Prof. E. J. Houston followed with a paper by himself and A. E. Kennelly entitled "A New Method of Measuring Illumination." The paper was discussed by C. H. Haskins, Elihu Thomson, A. E. Kennelly and Professor Houston.

Communications were read from the Cleveland Electric Railway Co. and the Cleveland Telephone Co., extending the free use of their lines to the delegates during their stay in the city, and letters and telegrams regretting inability to be present were read from H. W. Sexton, C. W. Price, Sylvanus P. Thompson, Marsden J. Perry, Nikola Tesla, Governor Wm. McKinley, Geo. Westinghouse, Jr. and C. A Coffin.

An executive session was then held, after which adjournment was taken until Wednesday.

WEDNESDAY, FEBRUARY 20.

At the morning session the Finance committee read its report. The report showed a balance on hand of $548.74 and no liabilities.

W. E. Harrington then read a paper on "The Correct Method of Protecting Electric Circuits," and was followed by C. N. Black with one entitled "Large Arc Dynamos."

The latter paper was discussed by S. M. Hamill, Prof. Elihu Thomson, Messrs. Townley, Prentiss and Smith, and the Association by way of diversion passed resolutions endorsing the Southern States Cotton Exposition at Atlanta.

The afternoon session was called to order at 2:30.

On the topic "How to Light Large Cities," Mr. C. H. Wilmerding made the following remarks:

The cost of lighting in Chicago, according to Professor Barrett's figures of a year ago, if I remember rightly, was $96.25 per lamp. This figure, it was stated, included nothing of interest, depreciation, insurance, taxes, etc., or what in a lighting company would be called expenses. In other words, it might be said to include simply labor and material. The cost per lamp installed was something in excess of $500, which at six per cent. interest on the original investment would amount to $30 per lamp, and a fair depreciation might be six per cent., which would add another $30, or a total of $60 to the cost; in other words, about $156 per lamp per annum. We are furnishing a few lamps to the city at $137.50 per annum, so that as a matter of fact we are supplying lights at a lower cost to the city than they can make it themselves. On that basis it seems reasonable to suppose that large cities should be lighted by private corporations rather than by the city itself. There is no question but that in every municipal organization in this country the cost of carrying on what may be considered a commercial or private business is much greater than where it is carried on by a private corporation, where all expenses are carefully considered.

At the conclusion of Mr. Wilmerding's remarks, Dr. Louis Bell read his paper on "The Monocyclic System."

The paper was discussed by Mr. John F. Kelly, C. P. Steinmetz, Professor Elihu Thomson and Mr. Scott.

In the discussion Mr. Scott raised several questions regarding the system, which were replied to at considerable length by the author of the paper.

At the conclusion of Dr. Bell's remarks a large bank of roses was brought into the hall—a present from the reception committee of the Cleveland ladies. These ladies tendered a banquet to the visiting ladies at the Stillman House and had not forgotten the gentlemen.

On motion of Mr. J. A. Seely a vote of thanks was tendered to the Cleveland ladies for their kind attention. The meeting then adjourned.

On Wednesday evening Mr. A. J. Wurts gave an address and a "Practical Demonstration of Protecting Lines from Lightning." The meeting was well attended.

THURSDAY, FEBRUARY 21.

At the morning session the discussion on Dr. Bell's paper on the Monocyclic system was resumed, Mr. W. R. Gardner, of Pittsfield, Mass., making a few remarks regarding

the two-phase system in his station, which, he said, was giving excellent satisfaction.

The Committee on Data then read its report.

Mr. W. R. Gardner suggested that the work of the committee be extended so as to give other items that enter into the cost of developing energy, aside from that of coal, and read the result in considerable detail of a test made by himself.

Mr. H. M. Swetland of the Data committee spoke of the difficulties met with in getting the facts for their reports. Responses were few. He asked if the report was of value to central station men; if so, continue the work; if not, drop it.

Mr. Hadley suggested that the reason why so few replies were received was because many central stations keep no records of the kind.

Mr. Barker, chairman of the Massachusetts Electric Light and Gas Committee, was called on and made some remarks regarding the work of the committee. He spoke of the proficiency of the gas records in that state and hoped to see the day when the electric light industry would equip itself with the same kind of details. He complimented the work of the Committee on Data.

A resolution was adopted "That the Committee on Data be directed to send out, as soon as possible after the adjournment of this meeting, blanks upon which records of central stations may be kept, with full instructions how to make the returns.

In answer to the President's suggestion thirty or more gentlemen present, managers of stations, expressed their willingness to keep these records and make returns.

At the executive session on Thursday afternoon, the following named officers were elected for the ensuing year: President, C. H. Wilmerding, Chicago, Ill.; 1st Vice-President, Frederic Nicholls, Toronto, Canada; 2d Vice-President, E. F. Peck, Brooklyn, N. Y.

Members of Executive Committee: E. H. Davis, Williamsport, Pa, (one year); W. R. Gardner, Pittsfield, Mass.; George A. Redman, Rochester, N. Y.; J. J. Burleigh, Camden, N. J.

The meeting then adjourned until May or June, 1896.

THE STORAGE OF ENERGY ESSENTIAL TO ECONOMY OF WORKING IN CENTRAL STATIONS.*

BY NELSON W. PERRY, E. M.

Supposing, in the case assumed, we endeavor to equalize the load by means of the storage battery. This will allow the boilers, engines and dynamos to work continuously at their most economical rate and would seem to provide ideal conditions of working. We are not, however, storing the product we have to sell, as is the gas manufacturer—we are not storing electrical energy, as some suppose, but, chemical energy, which must be transformed again into electrical energy before we can distribute it. These two transformations, of course, involve a loss of energy which must be provided for in boilers, engines and dynamos and also in coal. To be entirely fair with the storage battery, let us assume that its efficiency under all conditions is 75 per cent. Then in order that we may have at average working one electrical horse-power, we must provide:

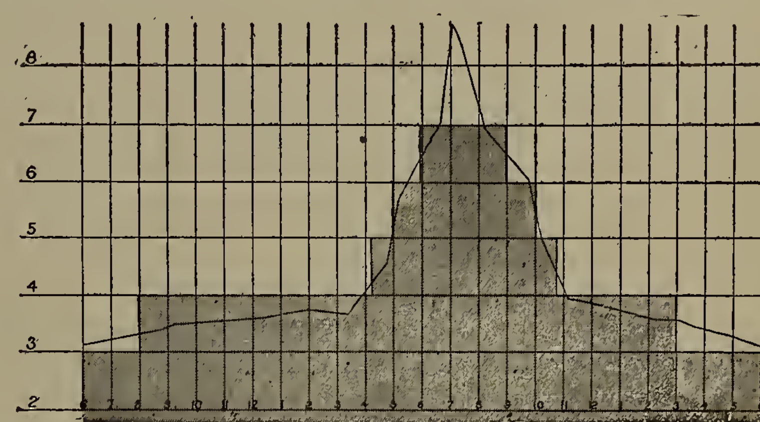
Boilers, $\frac{1.547}{.75} = 2.07$ at \$24	\$49.68
Engines, $\frac{1.547}{.75} = 2.07$ at \$44 5	92.12
Dynamos, $\frac{1}{.75} = 1.333$ at \$30	40.00
Buildings, say	125.00
Total investment, without storage battery	\$306.80

* Abstract of paper read before the National Electric Light Association, Cleveland, Ohio, February 19, 1895.

If we are to produce an average of one electrical horse-power per hour, we will produce 24 horse-power hours during the 24 hours, half of which must be stored, viz., we must have storage battery capacity for 12 horse-power hours. Of course, the rate of discharge will have some bearing upon the cost of this storage battery capacity, but taking an abstract case, we may assume, I think, without being unfair, that it will cost \$35 per electrical horse-power hour capacity erected. We must, therefore, add to our former figures, \$12 × \$35 = \$420, which is more for the batteries than we have allowed for all the rest of the plant put together, including the buildings.

The total fixed investment therefore becomes	\$726.80	
Interest on \$726.80 at 4 per cent	29.07	
Maintenance and depreciation		
Buildings, \$125 at 2 per cent	2.50	
Machinery, \$181.80 at 7½ per cent	13.64	
Storage Battery, 420 at 10 per cent	42.00	
Total fixed annual cost		\$87.21
Coal, 4 pounds for 8,760 hours, at \$1.75 per ton	30.63	
Petty stores, attendance, etc	13.37	44.00
Total annual cost per electrical H. P		\$131.21

which would be an actual loss over that of irregular working of \$131.21—\$117.78 = \$13.43. It will cost with the storage battery thus used, \$131.21—\$48.68 = \$82.53 more



ADJUSTING BATTERY STORAGE TO ELECTRIC LIGHT LOAD LINE.

than the same machinery working continuously on a steady load could produce it for.

If we assume coal to cost \$3.50 instead of \$1.75, the cost per electrical horse-power will be:

Steady load without storage battery	\$ 52.31
Variable load without storage battery	148.40
With storage battery	161.74

We thus see that the storage battery, on account of its extreme cost, is entirely out of the question as an economical device when thus used. This does not condemn its use in central stations in other ways, however, for there are many cases in which its use may contribute to economy, but these cases cannot be determined by any general rational formula. Each case must be determined for itself, and the result will depend, primarily, upon the shape of the load line, and secondarily, upon the ability of the battery to rise above normal discharge rate economically. In the case of a station previously equipped, without storage, so that the units are already determined, the question of economy of introducing storage batteries will be determined in some cases entirely by the sizes of those units.

In some cases where the day load is exceedingly light, it will not warrant the operation of the plant at all—the load costs more than it will bring in. In such cases there can be no question as to the economy of the storage battery, since it can be charged during the night by power that would otherwise be practically wasted, and during the daylight hours it may carry the whole load. In such cases it will effect an economy in another way also, viz., by carrying up to its capacity the peak of the load. The economy in this direction will be the greater the sharper the peak and will disappear as this flattens out.

But the manner in which the storage battery is most frequently employed to advantage in a central station is by changing the load line from the irregular one, due to the natural load, to one which would be formed by a series of rectangles which would in the aggregate have about the same area.

I have endeavored to illustrate this in the accompanying diagram. The irregular black line represents the natural load line. The spaces between the horizontal lines represent the units into which the equipment is divided, and the vertical lines the time at intervals of two hours.

Beginning at 6 A. M., the load is a little above the best output for three units, but without too much overloading these three units can carry it. The line gradually rises, however, until at 8 A. M. it becomes too much of an overload for three units. If a fourth unit were thrown in it would at first have to operate at only about one-third load, and hence very uneconomically. A storage battery load sufficient to make up a full load for this unit would, therefore, be thrown in at 8 A. M., and the new unit would thus work economically from the start. The part of the load furnished by the battery is represented by the shaded portion outside the natural load line—that is to say, this much energy is being absorbed by the battery and will be available at another time—less the loss due to inefficiency of the battery. I have assumed a battery efficiency of 75 per cent. We see from the diagram that the battery is charging 8 A. M. to about 4 P. M. Twenty-five per cent. of the energy *thus* stored will therefore be lost. It will be apparent that this bears no relation whatever to the total amount of energy being generated at the time, for units 1, 2 and 3 are working directly into the feeders and are not affected at all. The energy thus lost bears an exceedingly small ratio to the total energy generated.

At 4 P. M. the natural load consumes all the energy of the third unit, and in about 20 minutes has increased so as to be an overload. Now it depends upon circumstances whether we will bring our stored energy to the assistance of the fourth unit to carry the increasing load further or not. For the purpose of illustration I have assumed that we will not, but will throw in our fifth unit and complete its load by charging the battery. At ten minutes to five the load line crosses the fifth unit line, rising very rapidly, and the same question arises again, but I throw in my sixth unit at once, completing its load; the shaded area outside the natural load line again being the energy taken by the battery, 75 per cent. of which will be available. At 5:30 the load exceeds the normal capacity of all six units, but the diagram represents them as carrying the increasing load until 6 P. M., when the seventh unit is thrown in, and the load completed by the storage battery until 6:40, when the natural load requires the whole attention of all seven units.

Now the question arises, will it be necessary to add first an eighth and then a ninth unit to take this peak? If so, it will add considerably to the fixed charges on our power account. Will it be cheaper to supply battery capacity to carry this peak? That is a question to be decided separately for each individual case. Storage batteries will stand an abnormal discharge for a short time without serious injury. Some will stand it better than others. If it be too rapid the depreciation charge will be increased, also if this abnormal discharge be continued too long. Then, too, at rapid discharge the battery becomes less efficient and the loss will become greater than 25 per cent. It is only by balancing these losses against the advantages that the question can be decided whether it will be more advantageous to throw in an eighth unit and let the battery take care of only the tip of the peak beyond that, or let the battery take the whole of the peak beyond the seventh unit line. In the diagram I have assumed that the latter is more advantageous. The battery, therefore, discharges until 8:20, when it begins to recharge, supplementing the seventh unit load until 9 P. M., when the seventh unit is thrown out entirely, and the battery carries the remaining seventh unit load until 9:25, the battery load being represented by the unshaded triangle within the load-line, and so the battery and units continue supplementing each other throughout the remaining hours.

In this way the battery will prove economical with some curves. In others it may not, but whether or not it will depends upon so many contingencies that it is utterly impossible to state *a priori*. There are other considerations than economy that might balance its absence, such as convenience as a regulator of potential; the facility it affords for distribution to sub-stations at high potential, resulting in an economy of copper; and the subsequent transformation down for local distribution, and some others which will suggest themselves. Some of these might be controlled in special cases.

Then, on the other hand, the employment of the storage battery is limited entirely to the storage of energy when generated in the form of electricity; not only this, but it is still further limited to direct currents, and is therefore of no avail in stations sending out alternating currents.

DISCUSSION.

W. M. Stine.—There is no longer a question but that the use of storage batteries will effect a considerable saving under proper conditions, provided the storage battery employed be reliable. At this stage, if the expectations based on the storage battery be too high, disappointment will result and a good thing again rejected with contempt. For this reason prospective purchasers of a battery should be put in possession of needed caution and should be well aware of their faults in order to properly estimate their virtues. A storage battery plant, when it fails, fails so completely and involves such a relatively great expense, that it would seem only thoroughly competent men should be employed in their development and applications. An accumulator plant must be intelligently and judiciously cared for. Its efficiency at best is low, and should the charge or discharge be continued too long the total efficiency is greatly lowered.

At present it seems as if central station managers would not install a storage battery plant unless the life of the plate be guaranteed by the maker. This seems to be an unfair demand, unless the manager in turn guarantees the quality and extent of the attention to be given to the plant. A good cell may be ruined by injudicious as well as careless treatment, and the margin between proper care and unfair treatment is so narrow that such questions would involve endless complexity and litigation. It is only fair to the manufacturer that he guarantees his cells to be fairly uniform as regards capacity and efficiency, and the question of life be left with the purchaser, unless poor construction become evident in the life of the battery.

The considerations in selecting a battery for central station or power may in part be summed up as—

1. Plenty of lead in the elements. One maker places the quantity at two ampere hours capacity per pound.
2. Ample storage capacity for the work to be exacted from the battery. This should rather be over-estimated.
3. The plates should be well separated and easy of access for cleaning.
4. The mechanical strength of the plates should be able to withstand all charging strains.
5. The plates should be free from all soldered joints and the metal should be homogeneous.
6. The plates should be free from points that may be especially weakened by local action.
7. The active material should be so disposed that it may have the freest possible access to the acid.
8. The active material should be so thoroughly attached to the plates that it will not readily fall off in use.
9. The separate plates of an element should be so attached to the connecting bars that they may be readily removed for inspection or repair.

Herbert Lloyd.—The author, gives the total investment without storage battery as $306.80 per horse-power. The first error is in assuming that all the energy generated is stored. He assumes a loss of 25 per cent. of all the energy generated, but as only half is stored the loss should be but 12½ per cent. of the whole.

Instead of dividing by .75 he should have divided by .875, which gives the total cost of the machinery as $155.42 instead of $181.80.

Next as to cost of buildings: Taking the buildings at

$30, as in previous cases buildings without battery would cost $53.04. Adding 25 per cent. to this, which is very liberal, for battery building, we get $68.30, or a total of $223.73 instead of $306.80.

Next comes the cost of electric storage battery, which is given $35 to horse-power erected, or $420 for twelve horse-power hours, which would be necessary if the plant was half direct and half storage.

Where such figures could be obtained I am at a loss to understand. About 50 per cent. has been added to the real cost. A battery plant can be erected to-day for $24 a horse-power hour, which would give a total investment for a plant, half storage, of $223.72 plus $288, or a total of $511.72, instead of $726.80 as given.

It would be readily seen how the increased interest charge will affect the final result.

Next as to the maintenance of storage battery. Ten per cent. on the total investment of a central station battery is unheard of. Ten per cent. on the price of the lead plates is the highest maintenance contract which has come to my attention, and this would about correspond to 6 per cent. on the first cost of installation. So, instead of 10 per cent. on $420 as a maintenance cost, we have but 6 per cent. on $288 as an actual fact.

Again, in estimating the amount of coal consumed per electrical horse-power, Mr. Perry gives for steady work a coal consumption of 2.21 pounds. If charging batteries does not give regular load I would like to know what does, and yet he gives the coal consumption for charging batteries at four pounds.

Mr. Perry touches very lightly on the great utility of a battery to be discharged in from one to three hours as applied to taking the peak of the evening load. I learn from many large station managers that one and one-half to two hour battery is what they most need, and when it is borne in mind that a battery of this character costs to install but about $50 per horse-power, the situation acquires entirely new aspects. A direct plant, including boilers, engines and dynamos of the most durable aad approved machinery will cost certainly from $60 to $75 per horse-power, and I think the fact that storage battery can be installed, worked at one and one-half to two hour-rate for about $50 per horse-power, certainly brings electric storage to the front.

Mr. PERRY: The statement is made that I have charged too much for the depreciation of storage batteries, which is put at 10 per cent., and too much for the batteries. As to the cost Unwin puts it at eight pounds per horse-power hour storage capacity, or $40. Professor Forbes puts the figures at about the same for English practice. I thought I was safe in putting it at thirty-five. In regard to my charges for energy lost, I have put it at 25 per cent. With twelve horse-power stored, 25 per cent. of that would be lost if the efficiency of the battery were 75 per cent. That I have charged and nothing more. I have distinctly stated further along, where we apply it to a station, and change the character of our load-line, that the amount lost is only that part of the energy stored in the battery at that time, and has no reference whatever to the other units working below it. The figures stated by me are less than those given by the Electric Storage Battery Company.

C. L. EDGAR: We have been operating for the past year one of the largest storage batteries in the world. I think that I can answer a number of the arguments made in the paper, but not having seen it until the reading, cannot do it in detail. We pay for a four hundred horse-power battery 6 per cent. on the cost of the cell, which is about 4 per cent. on the cost of the installation, and for a ten years' guarantee. [Applause.] As the result of putting in the first battery a year ago, we are now putting in one double the size, so that we own to-day the largest in the world The original battery was put in after a personal investigation abroad, and I do not see how any one can go abroad and look at the batteries that are used there and have any hesitation whatever in putting in a battery, if you get a guarantee. It has never entered my head in the slightest degree as to whether a battery was economical. The only question which has come up has been, can you get a battery which will not deteriorate? We are saving 10 per cent. of our coal bill by a battery costing per horse-power one-half as much as our steam plant. We have in one of our stations a six hundred horse-power engine. We have four of them Our maximum load, purely Edison three-wire system, lasts for an hour and a half. I asked for specifications for a battery which would run six hundred horse-power one hour and a half. Having nothing to go by for American practice, I asked for a battery to duplicate one of our steam-engines. A first-class steam plant costs $100 a horse-power, everything inside of the building. That is being done to day. That battery cost us a little over $50 a horse-power to do the maximum work. We did not want it to do it for twelve hours. That would be the point Mr. Perry speaks of. We did not need it. We bought it for service during one hour and a half. Looking at it on that basis, we can save 50 per cent., or half of the money, by putting it into batteries, so that our total investment in the station, with half batteries and half steam, is only three-quarters of what it would be all steam. We bought the battery to take care of the maximum load, and have never used it for anything but the maximum load, and we still save 25 per cent. This is all assuming that the battery will be made to work, and you can get a guarantee. We succeeded in getting a ten years' guarantee from a firm absolutely reliable—one of the old firms in Germany—for a battery which, for 6 per cent. on the cost of the cells, not the switchboard or copper bars, they will take care of it. Up to the present time they have not spent a cent. That does not mean much, because it has only been running a year. The operation has been in the hands of a German, whom they sent here, who gets $12 or $15 a week. The discharge is for only one hour and a half.

A NEW METHOD OF MEASURING ILLUMINATION.*

BY EDWIN J. HOUSTON AND A. E. KENNELLY.

Measuring the illumination rather than measuring the intensity of separate lamps, would remove a source of great annoyance both to electrical engineers and to municipalities, by rendering unnecessary discussions as to the candle-power of incandescent or arc lights employed, since if the contract between the city and the lighting company be so drawn that the illumination in any part of a lighted street, for example, in the absence of moonlight, shall not be less than a certain minimum, all questions as to the candle-power of the separate sources will fail to affect the contract, and it only remains for the electrical engineer to provide such lamps as will, at the spacing employed, give the illumination contracted for.

The difficulty of obtaining a reliable portable standard lamp, the rather cumbersome size of the apparatus, and the fact that it does not obviate the difficulty of comparing illuminations of different colors, have led us to devise a new instrument based on entirely different principles. We call our instrument an illuminometer and have filed applications for a patent on the same.

A certain intensity of illumination is required to render a definite object viewed at a definite distance clearly delineated to the eye. It is well known that the illumination received upon the printed page of a book or newspaper must have a definite value in order to render the printed characters legible and that the intensity of the illumination so required will, for a normal eye, depend upon the size and character of the print.

We employ this principle in the operation of our illuminometer as follows: a small test object of, say, printed characters, is placed in a darkened box, sufficiently small to be readily carried in the pocket. The test object is exposed to illumination received from a translucent plate of porcelain or opal glass, which receives directly on its surface the illumination whose intensity is to be measured. Since the test object receives the light from this plate by

* Abstract of paper read before the National Electric Light Association, Cleveland, Ohio, February 19, 1895.

transmission and subsequent diffusion, it is the area of the translucent plate exposed to the test object in order to just render the latter legible to the eye, that determines the intensity of illumination upon the plate. A focussing eye-piece is placed opposite the test object for purposes of annulling the effect of any focal abnormalities of vision. A sliding shutter movable by a milled-headed screw, permits the effective area of the opal glass plate to be reduced until the amount of light received by the test object just permits of its legibility.

The total length of the instrument is 5½ inches, its breadth is 1.5 and its height excluding the milled-headed screw is 2¼ inches, so that the apparatus can readily be carried in the pocket. Its weight is 10 ounces.

It might be supposed that two different observers having different limits of distinct vision would obtain different results in determining a given illumination by the use of our instrument. In point of fact, however, we find that by the use of the focusing eye-piece, distinct vision of the test object being readily secured for each observer, the results of different observers do not appear to differ by more than the limits of probable error for the apparatus.

It will be evident that the advantage of such an instrument consists in the fact that it entirely dispenses with the necessity for the use of a portable standard of light, thus removing a constant source of unknown error in apparatus previously employed for this purpose. Moreover, the instrument does not require any great skill in its use, and with simple directions for use can readily be employed by an inexperienced observer.

It is evident that our illuminometer will permit a direct determination of the candle-power of a source of light by measuring the illumination produced at a fixed distance by that source of light alone. Thus, for example, if an incandescent lamp has its illumination measured at a distance of one metre from the centre of the filament, the number of luxes indicated by the instrument, when its window is perpendicular to the rays from the lamp, and all other sources of light are well cut off, will give directly the number of international or decimal candles in the lamp. It is, therefore, possible to measure the candle-power of a lamp in its socket, provided all other lamps in the neighborhood be extinguished, and that a black non-reflecting cloth be placed so as to prevent any appreciable amount of light from entering the windows except that radiated directly from the lamp.

Our illuminometer, therefore, becomes, indirectly, a portable photometer.

Apart altogether from the use of our apparatus, the National Electric Light Association doubtless recognizes the fact that there exists today no generally accepted standard of illumination. We would respectfully recommend that the Association consider the advisability of adopting as the unit of illumination the lux, or bougie-metre; i. e., the illumination produced by a decimal candle at a distance of a metre. This unit has been under consideration for some years, and has been provisionally adopted by several writers in this country and Europe.

DISCUSSION.

Professor Elihu Thomson thought the question of the measurement of illumination resolved itself into a physiological one. We know that visibility depends on contrasts. Our eyes take time to respond to sudden changes of illumination. It would be hardly proper to measure everything by legibility, depending on time of impression, because the illumination as to rate may come in there.

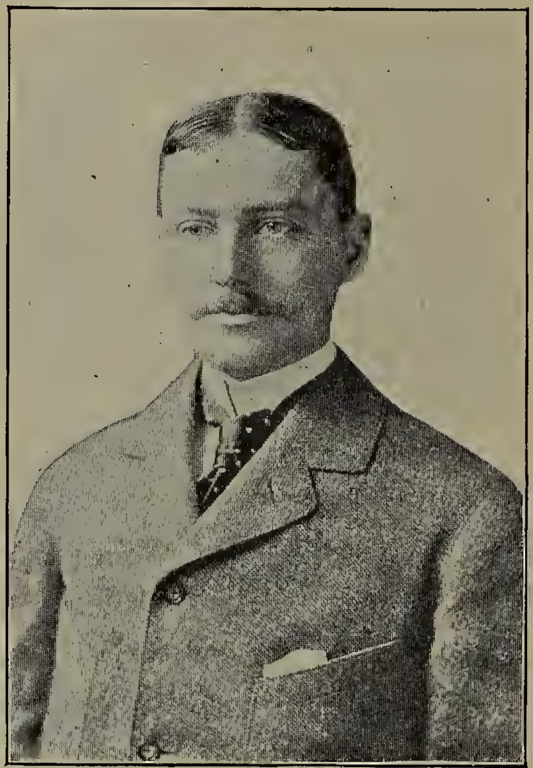
Another criticism he made was that the printed slip could be more easily read after it was used a while, on account of becoming familiar with the matter, and to change the printed slip every time might involve a change in the character of the surface. It was a question in his mind whether the paper would maintain its integrity as a surface for receiving and diffusing light. Paper is darkened by age.

Another question was the ability of the iris in different individuals to respond to light. Do the eyes have the same aperture to receive light? He doubted it. Then comes the question of color-blindness. He referred to these points as indicating the necessity, before adopting a method like the one under consideration, of comparing results of a large number of observations to find out whether there was a difference to be noted, or whether we could rely upon a fair average result.

A. E. Kennelly: In regard to what Professor Thomson has so eloquently explained with reference to the unfortunate power of our eyes. I grieve that our eyes should be open to such grave impeachment, and in fact I am only glad, after reading of the troubles to which we may be liable, that we have anything which we may call eyes at all. No two eyes see alike, and it is not possible to get an instrument, based on the agency of the eye, to be absolutely correct; but on the other hand I am pleased to remember that our eyes have some definite value, and just in so far as our eyes are perfectly normal, just in so far can we conduct the measurements relied upon.

PRESIDENT C. H. WILMERDING.

The new president of the National Electric Light Association, Mr. C. H. Wilmerding, was born in New York City in 1858, and is consequently 37 years of age. He received his early education in Germany and France, and afterwards took a course at the Sheffield Scientific School at Yale, graduating as a civil engineer in 1879. He was engaged in his profession in the construction of the water-



C. H. WILMERDING, PRES. N. E. L. A.

works in Troy, N. Y., and was later engaged in mining in Leadville, Col. He afterwards located and constructed a portion of the Rio Grande and Western Railroad. After this work Mr. Wilmerding returned East, and in 1884–85 was engaged as assistant engineer on the new Croton Aqueduct, New York City.

Early in 1888 Mr. Wilmerding went to Chicago, having become interested in electrical matters, and the same year became superintendent of the Chicago Arc Light and Power Company. He was afterwards made general manager of the company, and served in that capacity until the consolidation of that company with the Chicago Edison Company. Mr. Wilmerding now has charge of the operating department of both companies, which, under his efficient management, have become standard in central station work.

Mr. Wilmerding is an active member of the National Electric Light Association, and is always one of the foremost in the discussions at the meetings. He is progressive in every sense of the word, and it is safe to say that the association, under his guidance, will become a greater

power than ever. The ELECTRICAL AGE congratulates Mr. Wilmerding, and we are sure that we voice the sentiments of his many friends when we say that the honor is well bestowed.

EXHIBITS.

Mr. H. F. Tate, Western representative of the National Conduit Mfg. Co., with headquarters at Chicago, was at the Hollenden in the interests of his company. Mr. Tate is very popular in the West.

Mr. R. B. Smith, representative of the Belknap Motor Co., of Portland, Me., for Philadelphia, Delaware and the District of Columbia, had a fine exhibit. A neatly designed frame attracted considerable attention. The four corners represented the ends of commutators, and the frame was made up of woven wire brushes. The frame encased a black glass on which the name of the Belknap Motor Company was painted. Back of the glass were revolving colored lamps showing through the letters. The exhibit attracted a great deal of attention and Mr. Smith was kept busy answering questions and taking orders.

The Electric Engineering & Supply Co., of Syracuse, N. Y., was represented by J. D. McIntire, J. L. Hines and H. C. Hotchins, president of the company. The company had an exhibit of a full line of its specialties, and a large marble board fitted with switches of various styles, ammeters, voltmeters, etc., etc. The bus-bar clamps at the back of the board attracted a great deal of attention.

The Standard Paint Co., of New York, was ably represented by Frank S. De Ronde, general manager, J. C. Shainwald, of the Chicago office, and William Weirbach, salesman. P & B. cigars and samples of P. & B. goods were plentiful around the Hollenden.

Ned Fox represented the Phoenix Glass Co., Chicago, in room 306, with a full line of his company's well known goods.

Mr. Joseph Sachs, of New York, exhibited a full line of McCreary specialties of Mr. A. A. McCreary, of 136 Liberty street, New York.

The Mica Insulating Co., N. Y., had a sample board of armature and commutator parts. This company was represented by the Cuyahoga Supply Co., of Cleveland, Ohio.

The Interior Conduit & Insulation Co., of New York, exhibited one of their Lundell 10 H. P. motors and a Lundell rheostat. The exhibit also included a full line of Interior conduit tubing of all styles, junction boxes, etc., made by this company. Mr. E. W. Little and Mr. Romaine Mace represented the company.

Mr. H T. Paiste, of the H. T. Paiste Company, of Philadelphia, flitted about the Hollenden with his pockets full of H. T. switches, sockets, cut-outs, etc., and gave away *XN*tric pencils.

Mr. P. M. McLaren represented the Abendroth & Root Mfg. Co , of New York. He worked hard in the interest of this company's famous boilers.

E. H. Abadie, of the Wagner Electric Mfg. Co., of St. Louis, Mo., and Mr. W. A. Wagner of the same company, were present. Mr. Abadie showed the old and new ways of connecting up transformers. The fuse boxes contained in the new transformers are indestructible and will not hold an arc of 5,000 alternating current. The company's exhibit included switches, etc.

The Manhattan General Construction Co., of 50 Broadway, New York, was represented by Mr. S. Marsh Young, vice-president and general manager, Stuart W. Wise and William Jandus. Mr. Wise explained the features of the celebrated Manhattan Incandescent Arc Lamp, and scored many points in its favor.

H. E. Hall and C. W. Holtzer, of the Holtzer-Cabot Company, of Boston, Mass., exhibited all the new varieties of summer motors made by this company.

The Brush Electric Co., of Cleveland, Ohio, was well represented, and had parlor No. 137 at the Hollenden, where was exhibited the original Brush one-arc light dynamo, which was made 17 years ago. The company also exhibited a number of arc lamps, and distributed a plentiful and interesting supply of literature regarding the Brush apparatus in general. The company had a special car for the use of the guests to take them to the Brush works. Mr. S. M. Hamill, vice-president and general manager, L. H. Rogers, assistant general manager, A. H. Hough, secretary, W. S. Rogers, special agent, and A. D. Dorman, manager of the sales department, looked after the company's interests.

The Swan Lamp Co., Cleveland, O., was represented by R. E. Cox, secretary, W. H. Boardman and E. L. Nash. The exhibit consisted of a full line of Swan lamps both plain and frosted.

E. R. Stethins, treasurer, F. M. Faber, Pittsburgh agent, P. J Weberly, Michigan agent, and F. E. Bruce, of Cleveland, represented The Sterling Water Tube Boiler Co., of Chicago. They distributed literature regarding their well-known boilers. The Detroit Street Railway Co. has just contracted with the Sterling Co. for boilers with a total capacity of 4,000 H. P.

The Crane Co., Chicago, exhibited samples of their various valves. This company's valves are in extensive use in power plants. Mr. G. A. Hurd represented the company.

The Diamond Electric Co., Chicago, had on exhibition a Scheefer Recording watt-meter, and a Diamond transformer. Mr. A. M. Searles, manager of the sales department, was in attendance.

The Buckeye Electric Co., of Cleveland, had a beautiful exhibit in parlor B. It consisted of two pyramids of lamps, 5,800 in one and 1000 in the other. The lamps were of all sizes and styles. Special attention was directed to the frosted colored lamps for decorative purposes. The Buck's Head was decorated with small 10 candle-power lamps, with treble coil filaments. Among the newest lamps are the candle flame, and the bung-hole lamp, long and narrow, to facilitate examination of the interior of barrels. The new railway lamp attracted a good deal of attention. The exhibit included a full line of 100 c. p. lamps for any voltage from 45 to 130, and mounted on all styles of sockets. The company was represented by J. Potter, president; C. H. Rockwell, treasurer; Geo. R. Lean and Bailey Whipple. Mr. Whipple expects to take the exhibit to the Atlanta Exposition next fall.

The Standard Underground Cable Co., of Pittsburgh, had parlors 236 and 237, and exhibited samples of its well-known conduits. Mr. Mr. Geo. L. Wiley, the company's New York representative, and J. R. Wiley, its new Chicago representative, were present, impressing upon all comers the virtues of the Standard system. Mr. J. W. Marsh, vice-president and general manager, and Henry W. Fisher, the company's electrician, were also in attendance.

J. P. McQuade, secretary of the National Conduit Manufacturing Co., New York, was on deck entertaining his many friends, and keeping them in good humor with his inimitable stories.

J. W. Godfrey and F. W. Harrington occupied parlors 230 and 232 with a fine line of samples of Habirshaw wires and cables. Two samples in particular attracted a good deal of attention. One was 2,000,000, and the other 1,500,000 circular mills, and they were set in a block of pine wood. On one mahogany sample board were end samples of wires and cables finished off with polished brass rings, and on another similar board were similar samples without the rings. Their exhibit also included Red, White and Blue core wires.

The interests of the Cutter Electrical Specialty Co., of Philadelphia, were looked after by President H. B. Cutter. Mr. Cutter had samples of all the celebrated C.-S. specialties, including flush double-pole switches, flush commutation switches, C.-S. flush automatic switches, etc., etc. The C.-S. automatic magnetic cut-out is a very valuable accessory for the electric light. It saves life and property.

The Fort Wayne Electric Corporation, of Fort Wayne, Ind., was well represented by C. S. Knight, vice-president, S. A. Douglas, of the New York office, G. A. Wilbur, of Philadelphia, T. J. Ryan, Cincinnati, Thos. Cooper, Columbus, O., and C. E. Wilson, Chicago. The company's headquarters were in parlor 128, Hollenden, and small models of the "Wood" transformers were given away as souvenirs.

The Michigan Electric Co., of Detroit, Mich., exhibited at the Hollenden a new dynamo of the Detroit Electrical Works' make. Mr. J. E. Lockwood, president of the company, looked after its interests.

In parlor 114, the Hill Clutch Works, of Cleveland, was represented by H. W. Hill, president, and S. S. Leonard. These gentlemen displayed photographs of their goods; also a model of the company's self-oiling bearings.

The Reliance Co., Cleveland, O., occupied parlor 101, Hollenden, and Mr. H. E. Higgins, vice-president, exhibited Reliance safety columns, Reliance balanced steam traps, and Reliance steam separators.

H. L. Shippy, of the John A. Roeblings Sons' Company, had a full line of that company's well-known wires and cables in parlor 101. Mr. Bowman is the local agent for this company.

The Cleveland Electric Mfg. Co. exhibited one of its watchman's clocks and other small specialties which they manufacture.

A full line of Paragon Insulating Co.'s materials was exhibited in parlor 101. The company's headquarters are at Cleveland, O.

The American Circular Loom Co., of Boston, was represented by H. H. Brooks and Jas. S. Wilson, superintendent. These gentlemen had a full line of this company's conduit on exhibition. They gave away a trade awakening whistle, which the convention guests used to advantage. The Cleveland Electric Mfg. Co. is the agent for the American Circular Loom Co.

The General Electric Co. entertained the members, guests and visitors in the banquet room, Hollenden House, and had an exhibit of apparatus, supplies, etc., at the new station of the Cleveland Illuminating Co.

The Solar Arc Lamp Co., of Brooklyn, N. Y., had an exbibit of its celebrated lamps in charge of Mr. Joseph Sachs. These lamps attracted a great deal of attention.

The King Insulator Co., of Cleveland, Ohio, exhibited a full line of insulating materials.

The Forest City Electric Works, of Cleveland, Ohio, exhibited a full line of commutator "Roll Drop" bars. Mr. W. B. Cleveland, president of the company, was in attendance.

Eppinger & Russell Company, 66 Broad street, New York City, had a sample of its Valentine subway electrical conduit in parlor 101.

P. F. Moran and U. G. Graham represented the Clonbrock Steam Boiler Works, of Brooklyn, N. Y., manufacturers of the celebrated Morrin "Climax" steam generators.

The Carpenter Enamel Rheostat Co., of Hoboken, N. J., had an exhibit of its well-known goods at the Hollenden. H. Ward Leonard, president, and C. E. Carpenter, vice-president, were in attendance.

Heubel & Manger, 286 Graham street, Brooklyn, N. Y., had a full line of pushes, bells, etc., and was represented by W. W. McChesney, Jr.

A. L. Daniels represented the Akron Insulating & Marble Co., of Akron, Ohio. Mr. Daniels had on exhibition a full line of this company's goods, including standard tubing.

W. D. Packard, secretray and treasurer, and H. W. Wilson, of the New York & Ohio Co., Warren, O., were at the convention and had an exhibit of Packard lamps. The exhibit included lamps of 500 c. p. taking 12 amperes at 110 volts, also transformers and fuse boxes.

The Sweet Electric & Mfg. Co., Grand Rapids, Mich., was represented by S. Barnes, electrician. Mr. Barnes showed the Sweet automatic switch for lighting and power station work, for both direct and alternating currents. Four thousand of these switches are now in use.

A. W. Mayers, general manager of the Multifuse Switch Co., of Cleveland, exhibited this company's switch, which was described and illustrated in the ELECTRICAL AGE of February 19.

Mr. L. R. Albergers, 88 Liberty street, N. Y., distributed copies of advance circulars regarding the Worthington Self-cooling condenser, which is being talked about considerably in the trade.

The Perkins Electric Switch Mfg. Co., Hartford, Conn., exhibited a full line of samples of switches, and was represented by G. W. Conover and J. J. Gates, general manager.

The Boudreaux dynamo brush, manufactured by Boudreaux Dynamo Brush Co., Chicago, was exhibited in parlor No. 101 of the Hollenden.

A new Helios arc lamp for direct current was shown with a focussing lens, throwing signs on a canvas. Another in series with the first, similarly arranged with lens, showed the crater of the arc on the canvas. These lamps formed part of the exhibit of the Central Electric Co., of Chicago, which was under the care of C. G. Burton. Mr. Burton remarked that he was reflecting glory with the Helios lamps, Okonite wires and interior conduit. Mr. Geo. A. McKinlock, president of the company, was present during the convention.

R. W. Thompson, of Robert W. Thompson & Co., Cleveland, Ohio, showed one of that firm's ice-cutting and adhesion trolley wheels.

George H. Mills represented the New York Carbon Works, of 41 Cortlandt street, New York. Mr. Mills will make a tour of the West before returning home. He had great success in getting orders at the convention for his company's celebrated carbons.

The Elliott–Lincoln Electric Co, of Cleveland, Ohio, exhibited one of its new direct current motors.

Mr. J. K. Martin, of James J. Murray & Co., the well-known glass works of Philadelphia, had an exhibit of a full line of this house's celebrated shades, etc.

T. C. Warley & Co., manufacturers of boiler cleansing compounds,

TABULATED REPORT OF DATA RECEIVED FOR THE NATIONAL ELE

No. of Report.	EQUIPMENT.						PRODUCTION.										
	ENGINES.		BOILERS.		DYNAMOS.		ARC CIRCUIT.				INCANDESCENT.				P WER.		
	Class.	Water Consumption Per H. P.	Class.	Evaporation Per Pound of Combustible.		Efficiency.	Average Amperes.	Average Voltage.	Hours Run.	Total Watts.	Average Amperes	Average Voltage.	Hours Run.	Total Watts.	Average Amperes.	Average Voltage.	Hours Run.
22	A	17	A	9.37	Multipolar.	85					7670	124.9	24	22,967,952			
1	B & F		C & D		Con. and Bipol.		10	8145	24	1,954,800	224	1140	24	6,128,640	50	500	13
9	B		C		Multi., Alt., &c.		10	2387	13	5,896,081			24	2,434,500		500	
15	F		C		Arc, Alt.		6.8	47	4	1,278	66.4	1010	15	67,064			
8	E	27¼	C		Alt. & Con.		10	1000	12	120,000	37	1100	13	529,100			
18	B X F X	32.7	C	11.3	Alt. & Con.		6.7	7000	8	355,144	7.05	1172	24	1,983,024	42.4 80.3 65.2	1142 325 548.2	23¼ 10 16½
12	B		B	8.4	Arc.		9.5	48	14	10 552,752							
2	B E Z	15.5	A		Various.		9¼	4800	12	6,600,000	150	2200	24	7,920,000		250 525	24 18
16	E		C		Arc, Alt.		by	Meter.		246,000				580,000			
13	C X	24	C	10.5	Various.		6.8	2275	14	7,042,426							
10	B F	23.6	B	11.34	Alt., Bipolar.		9.8	50	12	1,817,256	137	1130	24	3,715,200	36	535	24
21	C X		A C		Alt., Bipolar.		6.8			1,779,051	37		16½	837,930			10½
17	B E		C		Alt., Bipolar.		6.8		7	357,000	40	1200	14	672,000			
19	F		C		Alt.		6.8	1100	5¾	43,010	27	1100	7½	Meter. 224,400			
3	A Y	18	C	8.8	Alt., Bipolar.		10	Meter.	24	1,990,000		Meter.	24	90,900			24
20	F		C	9.02	Various.		6.8	6500	8 1-3	367,333	100	240	16	384,000			
14	A				Various.						6000	116	24				
4			A		Various.		10	3472	24	833,250	339	117.5	24	3,823.600	23	1060	24
7	F		C	7.68	Alt.		6.8	1150	7¼	56,840	24	1040	7¼	105,560			
6	F		C		Alt.		6.8	656¼	8	35,700	16.75	2000	8	268,000	5	3916	6.5
5	G X		A		Con. & Mult.						180	116.6	24	2,016,000			
11							10	50		1,500,000	104 140	120 1100	24 24	3.700,000 299,000	32	550	14
23	B E X		A								160	1000	16	1,640,000			
24	F		C	6.3	Various.		10	50 ea.	12	1,104,250	112	1120	12	1,505.280	45	223.5	18

EQUIPMENT.

CLASS A. Boiler Room: Horizontal Water-tube boilers; feed through heaters by steam or power pump; hand firing. Engine Room: Triple Expansion Condensing Engines. Dynamo on Engine Shaft.

CLASS B. Boilers Vertical Water-tube; economizers, feed as A. Hand firing. Engines, Corliss Compound Condensing, belted to jack shaft.

CLASS C. Boilers, Horizontal Tubular, feed as A; Engines, Si

Corliss or slow speed, condensing, belted to jack.

CLASS D. Boilers, Upright Tubular; feed as A; Engines, Si

Corliss, Non-condensing.

CLASS E. Engine, High Speed Compound Condensing, belted di

The Partridge Carbon Co., of Sandusky, Ohio, manufacturer of motor and dynamo brushes, was represented by Jas. Partridge.

Mr. E. Nashold, general manager of the Nashold Cleat Co., of Chicago exhibited samples of cleats.

The Electric Selector & Signal Co., 45 Broadway, New York, showed its electric light and power controllers in practical operation. C. P. Mackie, general manager, P. H. Alexander, manager light and power department, and A. L. Searles, electrician, were present and explained the operation of the company's system.

The Cutler-Hammer Mfg. Co., Chicago, had a display of its fireproof rheostats for all purposes.

The Weston Electrical Instrument Co., Newark, N. J, as usual made a fine display of its well-known instruments. A station meter of a capacity of 80,000 amperes was one of the features. The exhibit was in parlor 134, and Mr. R. O. Heinrichs, from headquarters, and C. D. Shain, the New York agent, were present.

Morris & McCurdy, of Indianapolis, Ind., had some samples of Phoenix Rubber Insulating Paint. Mr. Elmer P. Morris represented the firm. Mr. Elmer P. Morris, of the firm, used a Vulcan Torch to show the great fireproof qualities of their Phoenix Paint for all insulating purposes.

Philadelphia, were represented at the convention. This company has opened agencies at Chicago, Detroit and Milwaukee, and did more business during the last six months than at any time previous.

The Auto-Telephone system, of which the Tucker Electrical Construction Co, of Whitehall street, New York, is the sole licensee, was represented by Thos. McCoubray.

Chas. A. Schieren & Co., manufacturers of the celebrated perforated electric belting for electric railways and electric lighting, 47 Ferry street, New York, distributed pamphlets, giving much valuable information regarding the manufacture of these belts, etc.

Mr. Charles E. Gregory, president of the Chas. E. Gregory Co, of Chicago, represented this company and distributed a pamphlet souvenir.

A representative of the American Engine Co, Bound Brook, N. J., distributed circulars regarding its high grade dynamo electric machinery and electric motors. These machines are designed by Mr. O. P. Loomis, treasurer and electrician of the company.

The Page Belting Co., of Concord, N. H., distributed a little book, giving much valuable information regarding belting.

The Electric Storage Battery Co., of Philadelphia, showed a large storage cell. Mr. W. W. Gibbs, president of the company, attended the convention, with headquarters at the Hollenden.

REPORT OF THE COMMITTEE ON DATA.

The information contained in the tabulated report submitted herewith, while recording data from fewer places than usual, is believed to contain correct information and more than usual detail. Certain classes of equipment are not reported in sufficient numbers to warrant correct averages, but every central station manager will find in the table a style of equipment sufficiently like his own to enable him to compare results with at least a few others who are similarly equipped. The table contains reports from twenty four stations using coal as fuel. The highest economy is shown in report No 22, where 262 watts are generated from one pound of coal, the plant furnishing nearly 23,000,000 watts during twenty-four hours, the equipment being triple expansion engines with dynamo on the engine shaft, and horizontal water-tube boilers with heaters, with-

' ASSOCIATION.

	FUEL.		
[TO]TAL [W]ATTS [FRO]M ALL [CIR]CUITS.	WHOLE AMOUNT OF COAL USED IN ONE DAY.	WATTS PRODUCED PER LB. OF COAL.	KIND AND GRADE OF FUEL.
67,952	87,358	262	½ Soft Coal, ½ Hard Screenings.
08,440	46,700	180	Hocking Screenings.
53,331	59,884	177	Run of Mines, Alabama.
97,238	5,460	182	George's Creek, Cumberland.
49,100	3,700	175	Cumberland.
13,846	24,750	174	Pennsylvania Soft Coal.
52,752	62,000	170	Soft Coal.
78,250	50 tons.	158	Slack and Nut.
74,000		150	Pocahontas, Soft.
42,426	50,238	140	Babylon Pea.
97,456	45,000	133	Illinois Washed Pea.
06,981	21,203	132	George's Creek, Cumberland.
29,000	8,000	128.6	Coaldale, Bituminous.
67,410	2,200	121	Pocahontas, Cumberland.
49,000	35,322	108	Michigan Run of Mines, Poor.
45,333	8,131	104	Cumberland and Hard Screenings
04,000	164,000	100	Buckwheat, No. 1 and 2.
41,500	60,283	86	Illinois Lump and Nut.
62,400	1,963	83	Second Youg'y, Nut.
30,996	6,583	80	Indiana Slack.
16,000	25,600	78	Illinois Nut.
08,850	86,750	69	Soft Slack.
40,000	42,000	44	Indiana Block.
90,565	79,800	30	Bituminous Pea.
	11,900		Bituminous Slack.

Engines, High Speed Simple Non-Condensing, belted direct.
Engines, High Speed Compound Non-condensing.
Any of the above non-condensing.
Belted to dynamo.
Dynamo on the Engine Shaft.

out economizers, the firing being done by hand. This result is secured from one half each soft coal and hard screenings. An examination of this report proves it to be a high average for twenty-four hours, as with an evaporation of 9.37 pounds of water per pound of combustible, and a water consumption of 17 pounds per horse-power, allowing 10 per cent non-combustible in the coal, and taking the efficiency of the generators as stated at 85 per cent. we have $\frac{9.37 \times .90}{17} \times 746 \times .85 = 314$ watts produced from one pound of coal. This average is much nearer the theoretical efficiency of a modern steam plant than any report previously received by this committee.

Taking an average of the ten reports from stations generating over 5,000,000 watts in twenty-four hours, we have 147.5 watts per pound of coal, or a production of one electrical horse-power for four pounds of coal on a basis of the efficiency of the generating machinery as stated in the last report by this committee.

Previous reports by this committee have been criticised as inaccurate and incomplete, and an attempt has been made in the work here submitted to improve it in both these particulars. From the first the results of this work have been handicapped by reports from the central stations incorrect, incomplete, and based upon a variety of testing instruments constructed without any absolutely uniform standard. And again, many central station managers do not wish to have their work made public, and in order to get at the results secured by these people, the information has previously been furnished to the committee, through your secretary, in such a manner that the committee were relieved of the responsibility of the exact source of the information furnished. This, in a measure, defeats the main object of the work.

We submit what has been done, trusting that it may prove useful, and that it may be elaborated and improved if found of sufficient value to central station managers to warrant their more complete and careful co-operation.

Committee: H. M. Swetland, New York; C. R. Huntley, Buffalo, N. Y.; E. F. Peck, Brooklyn, N. Y.; G. H. Blaxter, Pittsburgh, Pa.; E. W. Rollins, Denver, Col.; W. A. Whittlesey, Pittsfield, Mass.; E. L. Powers, Chicago, Ill.; J. A. Van Etten, Little Rock, Ark.; H. W. Sexton, Anniston, Ala.

ATTENDANTS.

Angle, H. M., Chic. Cross-Arm Co., Chicago.
Almstead, J. A., Citizens' L. & P. Co., Rochester, N. Y.
Ackerman, P. C., Am. Elec. Works, New York.
Adams, H. C., Phillips Ins. Wire Co., New York.
Alberger, A. R., H. R. Worthington, New York.
Alexander, P. H., Elec. Sel. & Sig. Co., New York.
Ayer, J. I., Marks-Ayer Elec. Co., New York.
Austin, M. B., Safety Ins. Wire & Cable Co., Chicago.
Abadie, E. H., St. Louis.
Armstrong, E. A., Camden, N. J.
Browning, H. L., Cleveland.
Bolton, W. B., Brush Elec. Co., Cleveland.
Barnes, S., Sweet Elec. & Mfg. Co., Grand Rapids, Mich.
Bryant, W. C., Bryant Elec. Co., Bridgeport, Ct.
Boardman, Jr., T. A., Swan Lamp Co., Cleveland.
Bergtheil E., Bergtheil & Young, London, Eng,
Badger, jr, F. H., Quebec.
Burke, J, Herrick & Burke, New York.
Bruce, F. E., Sterling Boilers, Chicago.
Benedix, H., Chicago.
Barrett, J. P., City Electrican, Chicago.
Burton, C. G., Central Elec. Co., Chicago.
Baird, M. R., Eddy Elec. Co., Windsor, Conn.
Brush, C. F., Cleveland.
Babcock, E. L., Cuyahoga Falls, O.
Baker, jr., C. O., Newark. N. J.
Baker, jr., Mrs. C. O., Newark, N. J.
Bernard, E. G., Troy, N. Y.
Brady, T. H., New Britain, Conn.
Bragg, C. A., Philadelphia.
Bragg, Mrs. C. A., Philadelphia.
Burleigh, J. J., Camden, N. J.
Bibber, C. E., Cutter Elec. Mfg. Co., Philadelphia.
Bell, Dr. Louis, Schenectady, N. Y.
Brown, C. E., Cent'l Elec. Co., Chicago.
Bakenell, Allan C., Int. Con. & Ins. Co., New York.
Belden, A. J., Belden & Seely, Syracuse, N. Y.
Burns, Chas. T., Rochester, N. Y.
Coles, S. L, *Electrical Review*, New York.
Colvin, F. R., New York.
Conover, jr., A. B., J. A. Roeblings Sons', Chicago.
Cooke, J. H, Chicago.
Cooke, E. W., Chicago.
Cutter, Geo., Elec Specialties, Chicago.
Collins, W. F., *Western Electrician*, Chicago.
Crossman, T. E., Official Stenographer, Brooklyn.
Colby, J. A., Des Moines, Ia.
Colby, Mrs. J. A., Des Moines, Ia.
Coleman, S. G., Badger Ill. Co., Milwaukee.
Cabot, J. A., City Electrician, Cincinnati.
Cruikshank, L. B., Hazleton Boiler Co., New York.
Conover, G. W., Perkins' Switch Co., Hartford.
Childress, H. L., Postal Tel. Co., Cleveland.
Cleveland, W. B., Forest City Elec. Works, Cleveland.
Carpenter, C E., Carpenter Ena. Rheo. Co., Hoboken.
Case, Wm., Hoopeston, Ill.
Cutter, Geo., Chicago.

Corriveau, A. J., Montreal.
Cram, H. B., Berstein Elec. Co , Boston.
Candee. Capt. W. L., Okonite Co., New York.
Colby, E. A., Baker & Co., Newark.
Crouse, J. B., Crouse–Tremaine Co., Fostoria, O.
Coughlin, W. H , Worcester Elec. Light Co., Worcester, Mass.
Daniels, A. L., Akron Ins. & Marble Co., Akron.
De Ronde, F. S., Standard Paint Co., New York.
De Ronde, Mrs. F. S., New York.
Douglas, S. A., Fort Wayne Elec. Corp., New York.
Davis, H M., *Electric Power*, New York.
De Land, Fred, Chicago.
Duffie, jr., C. R., New York.
Edgar, C. L., Edison Ill. Co., Boston.
Edgar, H. T., Atlanta, Ga.
Fox, E. H., Phoenix Glass Co., Chicago.
Francisco, Don Carlos, Rutland, Vt.
Francisco, I. H., Rutland, Vt.
Francisco, M. J. Francisco, Rutland, Vt.
Francisco, Mrs. M. J., Rutland, Vt.
Flanagan, T. F., Portsmouth, O.
Foster, H. A., *Electric Power*, New York.
Fairbanks, H. H., Worcester, Mass.
Gates, J. J., Perkins' Switch Co., Hartford.
Grier, Thos. G , Chicago.
Graham, U. G., Clonbrock Boilers, Brooklyn.
Gardner, F. F., Newark E. L. & P. Co., Newark, N. J.
Gibson, C. L., Cleveland.
Greene, B. E., *Electricity*, New York.
Godfrey, J. W., Habirshaw Wires, New York.
Graves, W. D., Cleveland.
Greene, S. D., Gen. Elec. Co., Schenectady.
Gallagher C., Nat. Con. Mfg. Co., New York.
Gardner, W. R., Pittsfield, Mass.
Harrington, W. E., Philadelphia.
Harrington, F. W., Habirshaw Wires, New York.
Huntley, C. R., Buffalo.
Hamill, S. M., Brush Elec. Co., Cleveland.
Hill, W. H., Hill Clutch Works, Cleveland.
Hatch, E. B , H. W. Johns Co., New York.
Howell, W. S., Gen. Elec. Co., Harrison, N. J.
Hine, H. S., Wallace Elec. Co., Chicago.
Hart, G. W., Hart & Hegeman. Hartford, Ct.
Herrick, H. B., Herrick & Burke, New York.
Holmes, W. E., Newton, Mass.
Higgins, E. M., Citizens' L. & P. Co., Rochester, N. Y.
Hurd, G. A., Crane Co., Chicago.
Hambay, J. T., Beacon V. P. & Elec. Co., New York.
Holtzer, C. W., Holtzer–Cabot Elec. Co., Boston.
Hine, Henry, Stanley Elec. Mfg. Co., Pittsfield, Mass.
Heinrichs, E. H., Westinghouse Co , Pittsburgh.
Heinrichs, R. O., Weston Elec. Inst. Co., Newark, N. J.
Harding, H. McL., Walker Mfg. Co., New York.
Higgins, H. E., Reliance Gauge Co., Cleveland.
Herrick, C. H., W. S. Hill Elec. Co., Boston.
Hunt, W. T., Electrical Age, New York.
Johnston, W. J., *Electrical World*, New York.
Johnston, Mrs. W, J., New York.
Jones, A. J., Edison Ill. Co , New Brunswick, N. J.
Kittle, E. B., Pettingell–Andrews Co., Boston.
Kimball, F. M , Gen. Elec. Co., Boston.
Kelly, Jas. F., N. Y. Ins. Wire Co., New York.
Knight, C. S , Fort Wayne Elec. Corporation, Fort Wayne.
Kelly, John F., Stanley Elec. Co., Pittsfield, Mass.
Leonard, H. Ward, New York.
Learned, C. A., Hudson Elec Co., Jersey City, N. J.
Little, E. W., Int Con. & Ins. Co., New York.
Lockwood, J E., Michigan Elec. Co., Detroit.
Lindsey S., Essex Co. Elec. Co., Newark, N. J.
Linsey, J. W., Gen. Elec. Co., Chicago.
Markle, A., Hazelton, Pa.
McCoubray, T., New York.
Martin, J. K., J. J. Murray & Co., Philadelphia.
McGill. J. H., Peru Elec. Mfg. Co., Peru, Ind.
Mills, G. W., N. Y. Carbon Works, New York.
Mackay, W. H., Imperial Elec Lamp Co., New York.
MacCrenell, W. J., Amer. Inc. Lamp Co., St. Louis.
Marshall, N., Anchor Elec. Co., Boston.
Myers, G. M., Elec. Lt. & Water Co., Kansas City, Mo.
McGhie, J., Genl. Elec. Co., New York.
Manson, G. T.. Okonite Co., New York.
McQuaide, J. P., Natl. Cond. Mfg. Co., New York.
McKinlock, G. A., Central Elec. Co., Chicago.
McKinlock, W. H., Chicago.
Morse, S. F. B., Kerite Wires, Chicago.
McIntire, C. H., Newark, N. J.
McIntire, Mrs C. H., Newark, N. J.
McIntire, H. D., Syracuse, N. Y.
McIntire, Mrs. Syracuse, N. Y.
Manwaring, A. H., Philadelphia.
Manwaring, Mrs. A H., Philadelphia.
Magee, F. A., The E. S. Greeley Co., New York.
Marshall, C. S., Chic. Cross Arm Co., Chicago.
McLaren, P. M., "Root Boiler," New York.
McChesney, Jr., W. W., Huebel & Manger, Brooklyn, N. Y.
Moran, P. F., Clonbrock Boilers, Brooklyn.
Munder, C. F., Bryan-Marsh Co., New York.
Millett, C. W., Elec. Lt. & Power Co., Dolgeville, N. Y.
Millett, Mrs. C. W., Dolgeville, N. Y.
Mace, R., Int. Con. Ins. Co., New York.
Mackie, C. P., Elec. Sel. & Sig. Co., New York.
Marks, L. B., Marks-Ayer Elec. Co., New York.
Martin, T. C., *Electrical Engineer*, New York.
Nashold, E., Nashold Cleat Co., Chicago.
Munn, P. N., Telluride, Col.
Newton, C. E., Jewell Belt Co., Hartford, Ct.
Nicholls, Fred'k, Toronto, Ont.
Nold, C. S., Gen. Elec. Co., New York.
Osborne, W. F.. *Western Electrician*, New York.
O'Hara, J. B., *Western Electrician*, Chicago.
Oswald, E. H., Benedict & Burnham, Mfg. Co., N. Y.
Partridge, Jas., Partridge Carbon Co., Sandusky, Ohio.
Perry, N. W., *Electricity*, New York.
Phelps, G. M., *Electrical Engineer*, New York.
Porter, G. F., Secy. N. E. L. A., New York.
Purrington, A. J., New York.
Perry, F. L., *Western Electrician*. Chicago.
Powers, E. L., *Electrical Industries*, Chicago.
Peck, E. F., Brooklyn.
Potter, J., Buckeye Elec. Co., Cleveland.
Packard, W. D., Warren, Ohio.
Phipps, E. H., Conn. Pipe Mfg. Co., New Haven, Ct.
Pratt, H. T., Washburn & Moen Mfg. Co., Chicago.
Raymond, C. B., Goodrich Hard Rub. Co., Akron, Ohio.
Rogers, W. S., Brush Elec. Co., Cleveland.
Renehan, J. J., Mast Arms, New Britain, Ct.
Roberts, E. P., Cleveland.
Rockwell, C. H., Buckeye Elec. Co., Cleveland.
Royce, F. W., Royce & Marean, Washington, D. C.
Redman, G. A., Rochester, N. Y.
Redman, Mrs. G. A., Rochester, N. Y.
Rodman, S. A., Ravenna, Ohio.
Shippy, H. L., Roebling's Sons, New York.
Stump, C. E., *Street Railway Gazette*, New York.
Schieble, A., Chicago.
Shainwald, J. C., Standard Paint Co., Chicago.
Sullivan, M. J., *Electrical World*, Chicago.
Sullivan, Mrs. M. J., Chicago.
Sunny, B. E., Gen. Elec. Co., Chicago.
Smith, T. C., Philadelphia.
Shaw, A. C., *Electrical Engineer*, Boston.
Sperry, E. A., Cleveland.
Short, S. H., Walker Mfg. Co., Cleveland.
Searles, A. L., Elec. Sel. & Sig. Co., New York.
Seely, J. A., Complete Cons. Co., New York.
Seely, Mrs. J. A., New York.
Skeele, F. K., Cleveland.
Sullivan, M. A., C. A. Schieren & Co., New York.
Swetland, H. M., *Power*. New York.
Smith, J. B., Elec. Lt. Co,, Manchester N. H.
Smith, G. L., Western Elec. Co.
Smith, R. B., Belknap Motor Co., Portland, Me.
Smith, H. J., Edison Elec. Ill. Co., New York.
Smith, Mrs. H. J., New York.
Sachs, Jos., Solar Arc Lamp Co., New York.
Shain, C. D., New York.
Stirn, Louis, New York.
Stieringer, L., New York.
Stillwell, L. B. Pittsburgh.
Steinmetz, C. P., Gen. Elec. Co., Schenectady, N. Y.
Terry, F. S., Chicago.
Tolles, C. L., Jewell Belt Co., Hartford, Ct.
Thompson, R. W., Cleveland.
Thomson, Elihu, Gen. Elec. Co.
Taltavall, J. B., *Telegraph Age*, New York.
Wheeler, S. B., Morris Tasker & Co., Philadelphia.
Whitney, H. C., N. Y. Ins. Wire Co., New York.
Wiley, G. L., Stand. Und. Cable Co., New York.
Wiley, J. R., " " " " Chicago.
Wood, E. E., *Electrical Industries*, New York.
Wilmerding, C. H., Chicago Edison Co., Chicago.
Wilkins, E. W., Philadelphia,
Wason, C. W., Cleveland.
Wurts, A. J., Westinghouse Elec. Co., Pittsburgh.
Wagner, H. A., Wagner Elec. Co., St. Louis.
Wallace, J. B., Wallace Elec. Co., Chicago.
Wintner, St. L., Bklyn. Elec. Mfg. Co., Brooklyn, N. Y.
Walter, H. H., Arm. Carb. Co., Noblesville, Ind.
Whiton, H. D. Cleveland Elec. Ill. Co., Cleveland, Ohio.

CONVENTION NOTES.

Mr. C. H. McIntire, of the C. McIntire Co , 15 Franklin street, Newark, N. J., was at the Hollenden, meeting his many old friends and making new ones. Mr. McIntire is as well-known in the trade as the McIntire connectors.

The American Circular Loom Co. presented a syren whistle. These ear-splitting devices made the halls ring.

Mr. Henry Hine, general manager, and J. F. Kelly, electrical engineer, of the Stanley Electric Co., Pittsfield, Mass., were at the Hollenden. Both these gentlemen have a large circle of acquaintances.

Mr. George T. Manson, of the Okonite Co., never fails to be on hand at conventions. He was a guest at the Hollenden and a strong advocate of Okonite.

Mr. Elmer P. Morris, of the firm of Morris & MacCurdy, Indianapolis, Ind., was heartily greeted by his many friends. Mr. Morris is one of the best known men in the trade. He is an old Edison and General Electric man.

Thos. G. Grier and Edward R. Grier, brothers, the Bryant Electric Co.'s men in the West, gave the delegates a little book entitled "Stories That You Have Told And Heard Before." The stories were appropriate and bright.

J. W. Godfrey, manager of sales of Habirshaw insulated wires and cables, 15 Cortlandt street, New York, gave a neat little pocket memorandum book. It is hardly necessary to take any artificial means to keep Mr. Godfrey's name before the trade. The book will find ready use, however.

The McCreary folder illustrated in an excellent manner the various applications of McCreary portable lights.

HOW THE LADIES WERE ENTERTAINED.

On Tuesday afternoon various points of interest were visited, the local committee of ladies having charge of the function.

On Wednesday at 2 P.M. a lunch was given to the visiting ladies at the Stillman.

And on Thursday afternoon a visit was made to the Olney Art Gallery. At 8 P. M. the same day a reception was held at the Art Exhibition.

THE HOSTS

The local committee of arrangements and entertainment consisted of the following named gentlemen: Col. M. T. Herrick, S. M. Hamill, E. P. Roberts, Frank Billings, Robt. Lindsay, Samuel Scovil, C. Corbett, E. P. Sperry, J. B. Hanna, H. E. Andrews, J. Potter, Chas. F. Brush, E. L. Babcock, Geo. Cleveland, J. P. McKinstry, G. M. Hoag, W. H. Lawrence, C. H. Rockwell, F. De H. Robinson, N. S. Possons, W. B. Cleveland, S. H. Short, A. V. Kurtz, S. C. D. Johns and W. C. Hayes. The wives of many of these gentlemen, were indefatigable in their attentions to the ladies of the party. Cleveland's hospitality will long be remembered.

THE WESTINGHOUSE CO. AT THE CONVENTION.

The headquarters of the Westinghouse Electric and Manufacturing Co. were in the parlor of the "Hollenden" at the left of the main entrance. The company's exhibit consisted of a large lamp-board and the standard lightning arresters for alternating and direct-current circuits. The lamp-board display was especially brilliant. Here were shown the various styles of incandescent stopper lamps; 100 volt and 50 volt lamps of candle-powers ranging from 6 to 32 candle-power, were tastefully arranged upon the board exhibiting the perfection to which the "stopper" lamp has been brought.

The various patterns of ornamental lamps attracted much attention, as did also the high grade of glass employed in making the lamp bulbs and the glass shades of different shapes.

The exhibit of lightning arresters proved of special interest. The standard types of the well-known Wurt's non-arcing metal and Wurt's non-arcing railway arresters were mounted on a panel at one side of the parlor. The style of choke coil used with car equipments was also shown, and experiments made showing its action. Experiments illustrating the principles of lightning protection of railway, light and power circuits were continually in progress during the convention.

MRS. FRANCISCO'S SOUVENIR.

Mrs. M. J. Francisco presented each of the ladies of the party with a beautiful little souvenir. It was a silver plate one inch in diameter, suspended from a bow. Engraved around the rim were the words, "10th Anniversary N. E. L. A.," and in the bowl

F
Cleveland

$$C = \frac{E}{R}$$

1895.

It was elegant both in conception and design and was highly prized by the recipients.

THE GENERAL ELECTRIC COMPANY'S EXHIBIT.

The General Electric Company's exhibit was the most complete and comprehensive made at the convention. It occupied the entire second floor of the new station of the Cleveland Illuminating Company, and besides a display of supplies, was principally devoted to a working exemplification of the operation of the monocyclic system.

Arranged in a line down the centre of the room was a complete monocyclic plant, consisting of a 60 K.W. 60-cycle monocyclic generator, running at 900 revolutions and furnishing current to induction motors, incandescent lamps and arc lamps. The generator was driven by belt from a 50 K. W. 230-volt, four-pole slow speed, direct current motor of the type which the General Electric Company has recently developed, and in which it has embodied many important improvements. This motor was driven by direct current taken from the circuits of the Cleveland Illuminating Company.

Current for the monocyclic generator at 1,040 volts was taken through two 7,500 watt transformers to a 15 K. W. induction motor, also running at 900 revolutions, and this, in turn, was belted to an Edison bi-polar 12 K. W. generator supplying direct current to a number of incandescent and arc lamps, the latter of the already well-known Thomson '93 type. The straight current from the monocyclic generator was led through a 1,000-watt and a 15,000-watt transformer to a number of incandescent lamps and Thompson '93 alternating arc lamps, and these burned brightly and without flicker. In addition a five H. P. induction motor was also driven by current from the monocyclic generator, the current in each case being measured by Thompson recording watt meter.

A small two horse power direct current motor of a new and peculiarly compact design was also shown in operation.

Two handsome alternating focussing arc lamps and two direct current focussing arc lamps were also exhibited. The alternating current used was taken from the primaries of the Illuminating Company.

The exhibit of lighting supplies comprised a fine display of the porcelain specialties—switches, cut-outs, meters, etc., manufactured by the General Electric Company at its own works, and was rounded off by a handsome specimen of railway switchboard work, the controlling instruments being mounted on a fine panel of Tennessee marble, and by a twelve-inch search light projector.

The representatives of the General Electric Company were Professor Elihu Thomson and Messrs. S. D. Greene, E. W. Rice, Jr., Charles P. Steinmetz, Dr. Louis Bell, J. R. Lovejoy, B. E. Sunny, W. L. R. Emmet, A. D. Page,

Wilson S. Howell, C. D. Haskins, H. C. Wirt, under whose special care the exhibit was installed; W. F. Hays, F. Beran, F. M. Kimball, C. E. Harthan, G. F. Rosenthal, L. D. Tandy, Edgar Mix, Bostwick, Benbow and Greenwood.

BIOGRAPHICAL SKETCH.

COL. W. S. ROGERS.

Col. W. S. Rogers, of the Brush Electric Co., Cleveland, Ohio, is a man of wide acquaintance and varied experience. He was born in 1848. When 15 years of age he entered the volunteer service of the Union army, serving until the close of the war. In 1882–3 he was a member of the firm of Wiggins & Rogers and contracted for two years with the U. S. Government to furnish rock and timb-r for use in the improvement of the Mississippi below Cairo, Ill., employing from three to five hundred men in this work. He was Reading Clerk of the Illinois Legislature one term and in 1884 he was elected to the Illinois Legislature, and has the honor of being one of the one hundred and three who elected John A. Logan to the United States Senate. He was, during this time, appointed colonel

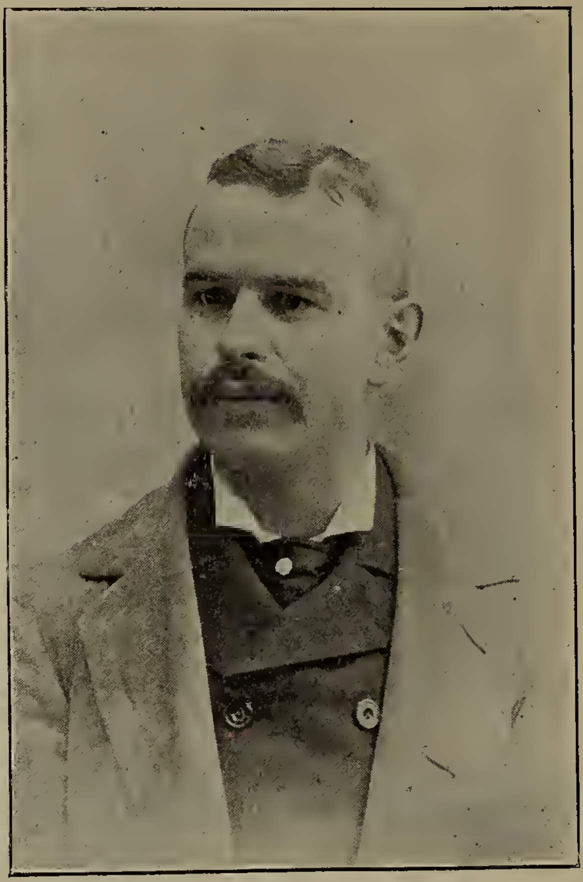
COL. W. S. ROGERS.

on General Ogleby's staff. About this time his attention was turned to electrical interests, and going to St. Louis he introduced and established the Electrical Accumulator Company and was prominent in all the earliest developments of electric lighting in that city. The Municipal Electric Lighting Company, the largest arc-light plant in the world, owes its inception to him. He superintended and carried to completion the construction of the Grand View Beach Railroad at Charlotte, N. Y., running seven and one-half miles along the shores of Lake Ontario, through ponds and swamps. In this work he was compelled to build 4,100 feet of trestle work. This road proved a great achievement in the electrical railway construction.

In 1891 he entered the service of the Brush Electric Company as special agent, in which capacity he has made some of the largest sales in the history of the company. Mr. Rogers is genial by nature, of keen observation and strictly loyal to business interests; he is a man of great executive ability and one of the best known men in the electrical business.

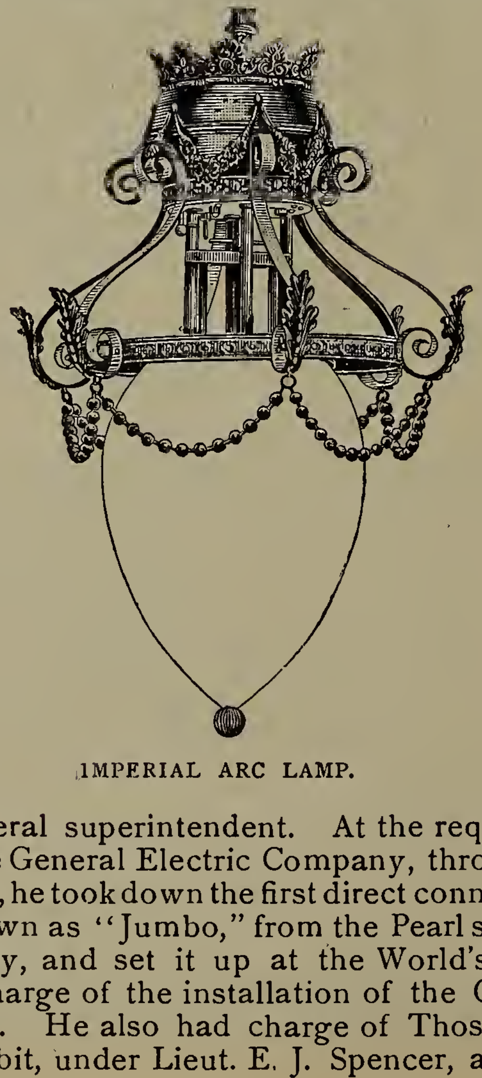
W. H. MACKAY.

Mr. W. H. Mackay was born in the year 1860 in New York city, his parents being Scotch Highlanders. His first electrical experience was in 1879 with the Brush Company in New England, shaving poles in two feet of snow. After remaining for a short time with Frank Riddell, who represented the Brush Company, he engaged with the Schuyler Company under Mr. Dalsell, and after serving with Mr. Dalsell for about a year, he went with the Edison people in Boston. From Boston he went to New York and served under Chas. B. Batchelor at Llewellyn Park and equipped the Edison Phonograph works for electric lights. He afterwards served under Mr. Suble and Mr. J. H. Vail as galva



W. H. MACKAY.

nometer man on subway work in New York city, and later was ordered South with Frank Sprague and S. D. Greene to assist in installing the Sprague Railway, at Richmond, Va. After his services at Richmond he travelled throughout the United States and Canada installing Edison central stations. He located as general manager for four years at Roanoke, Va., and installed the plant there. On his return from Roanoke, he engaged with the Edison Electric Illuminating Company, of New York, and served under H.



IMPERIAL ARC LAMP.

J. Smith, general superintendent. At the request of S. D. Greene, of the General Electric Company, through Superintendent Smith, he took down the first direct connected Edison machine, known as "Jumbo," from the Pearl street station, New York city, and set it up at the World's Fair, where he had full charge of the installation of the General Electric Company. He also had charge of Thos. A. Edison's personal exhibit, under Lieut. E. J. Spencer, and was com-

plimented very highly on his work at the Fair. After his return from the exposition he again became identified with the Edison Illuminating Company, and was with that concern until the middle of 1894, when he went with the Imperial Arc Lamp Company, Postal Building, New York city.

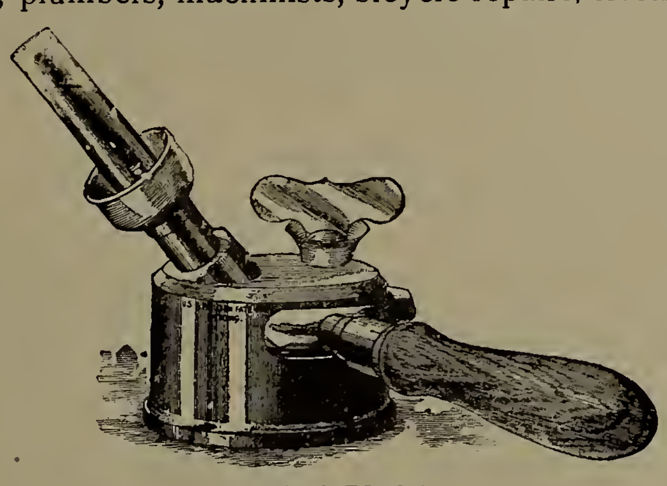
Mr. Mackay is well known from San Francisco to Canada, and in Germany, England and France. He has travelled all through South America, Central America and the West Indies, installing electric plants. The superintendents of the central stations throughout the country all know "Little Mack," as he is familiarly called, and a visit from him is always received with pleasure. He is a "hustler from way back." Since Mr. Mackay's connection with the Imperial Lamp Company, the lamp sales have very largely increased. When anyone wants a lamp, Mr. Mackay is always on deck.

The "boys," and especially the superintendents, were glad to see him at the convention.

Mr. Mackay has had to hoe his own way to the front through hard work.

THE VULCAN TORCH.

The accompanying illustration shows the Vulcan Torch made by the Vulcan Co., of 315 Madison avenue, New York City, N. Y. Either naptha or gasoline may be used, and at a cost of less than one cent will produce over 2,000 degrees of heat and maintain a steady blast for over an hour, generating its own gas. It has no pump or machinery of any kind; is simple in construction, easily handled and can be taken apart, and carried in the pocket. The Vulcan Torch has no equal for burning off paint and is very extensively used by car painters,. house painters and carriage painters, copper-smiths, gas-fitters; tin-smiths, roofers, plumbers, machinists, bicycle repairs, electricians,



VULCAN TORCH.

laboratory work, jewellers, engravers, etc. It is said to be the best Torch on the market and is giving great satisfaction.

The Vulcan Company is preparing to put on the market laboratory lamps and plumbers' furnaces, constructed on the same principle.

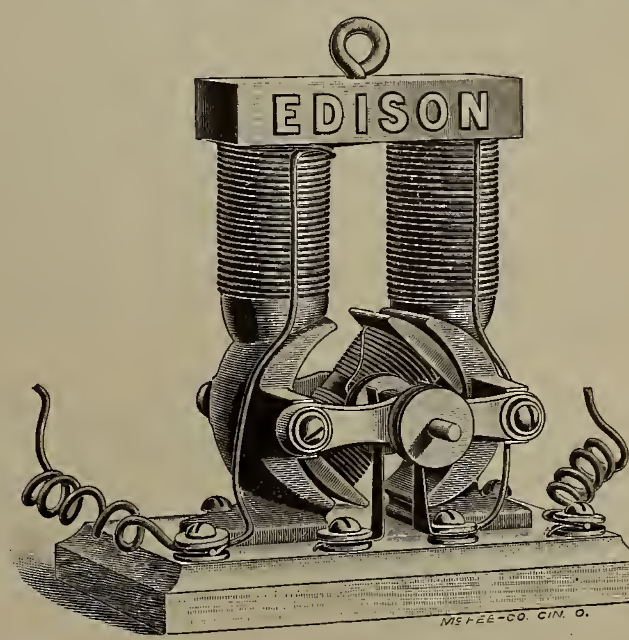
PHŒNIX RUBBER PAINT.

The Phœnix rubber insulating paint, exhibited at the Cleveland Convention by Mr. Elmer P. Morris, of Morris & MacCurdy, of Indianapolis, Ind., is manufactured from a newly discovered mineral, which is rich in natural oils.

It is first-class for armatures, fields, switchboards, conduits, iron and wood poles, etc., etc., where high insulation is essential. It is quick drying and does not crack, blister nor peel off. It is unaffected by extreme changes of temperature and can be used successfully on heated surfaces. It will stand 600° of heat F. without losing any of its properties, and is proof against acids, alkalies or salts. It is claimed to be the best and most durable insulating paint on the market The Phœnix paint was put to a severe test, during the convention, to prove its fire-proof qualities. The intensely hot flame from a Vulcan torch was applied to wires coated with this paint, but the latter resisted every effort to burn it. Metal, wood and magnet wires were coated with Phœnix paint and put to the fire test, and in every case the paint triumphantly survived the ordeal. Some of the largest electric light and electric railway plants in the United States are using the Phœnix paint with uniformly satisfactory results.

DOLLAR ELECTRIC MOTOR.

We herewith illustrate a perfect working model of an Edison motor or dynamo, manufactured by the Franklin Electric Co., manufacturers and dealers in small dynamos,



FRANKLIN ELECTRIC CO.'S MOTOR.

motors, students' and experimenters' supplies, Miamisburg, O.

It can be run by any battery, but their own battery is recommended as best suited for the purpose. This motor is a triumph of Yankee ability to manufacture cheaply It is a marvel in price. If made singly, each one would cost from $5.00 to $10.00. It is said to be the handsomest, the best made and the most powerful little machine ever put on the market for the money.

The motor will run at the remarkably high speed of 2,000 revolutions per minute, and develop sufficient power to run toy machinery or anything else that a toy steam engine would run. The field pieces are of a special quality of extra soft iron. The iron of the armatures is of still another quality, and specially treated to render it suitable to the purpose. The shafting is of the finest polished cold rolled steel. not varying a 1-1000 part of an inch in diameter. The bearings are of hard red brass, identically the same as that used on large machines. The armatures are turned true, and the field pieces so accurately bored as not to vary in the least. It is only by great expense that this company has accomplished this result.

ELECTRIC SERVICE AT THE CAPITOL.

A representative of the Electrical Age called at the office of the Compton Electric Service Company, Postal Building, New York, and was shown late views of the capitol and post-office building in Washington, D. C., where they have been highly complimented upon the installation of their electric service system for controlling the temperature in the rooms of these buildings, by Mr. Edward Clark, the architect of the United States Capitol. Mr. Clark, in a complimentary testimonial to the excellent manner in which they have installed the system, says: "The thermostats which you placed in the rooms of the Capitol have been in use some time, and have proven satisfactory. They prevent the heat from the coils heating the apartments above any degree of temperature at which the thermostat is set, adding much to the comfort of the rooms, as it prevents overheating in moderately cold weather, and also economizes in the use of steam. The Compton Electric Service Company have offices in the Postal Building, New York, Chicago, Boston, Washington and Baltimore.

Electrical and Street Railway Patents.

Issued February 19, 1895.

534,269. Electric-Light Switch. Harry W. Lawrence, Denver, Col. Filed May 31, 1894.

534,281. Electric-Current-Distributing System. Geo. B. Pennock, Boston, Mass. Filed June 1, 1894.

534,288. Magneto-Electric Machine. Henry J. Smith, Pompton Lakes, N. J. Filed June 8, 1894.

534,290. Automatic Brush for Railway-Tracks. George J. Smith, Covington, Ky. Filed June 25, 1894.

534,312. Street-Car Fender. Roderick L. Burleson, Carrollton, Ill. Filed Dec. 20, 1894.

534,315. Trolley for Cableways. Sebern A. Cooney, New York, N. Y., assignor of one-half to the John A. Roebling's Sons Company, Trenton, N. J. Filed Aug. 9, 1894.

534,318. Electric Winding and Synchronizing Device for Clocks. Charles M. Crook, Chicago, Ill. Filed June 23, 1894.

534,319. Electric Clock-Synchronizer. Charles M. Crook, Chicago, Ill. Filed June 2, 1894.

534,320. Electric Winding Mechanism for Clocks. Charles M. Crook, Chicago, Ill.

534,330. Electric Bell. William A. Harvey, Scranton, Pa. Filed Oct. 19, 1894.

534,359. Switch Device for Telephone-Circuits. Chas. Clamond, Paris, France. Filed July 5, 1894.

534,364. Signaling System. William E. Decrow, Boston, Mass. Filed Dec. 31, 1892.

534,373. Telephone and Signaling Circuit. Frank A. Pickernell, Newark, N. J., assignor to the American Telephone and Telegraph Company, of New York. Filed May 3, 1894.

534,374. Electrical Apparatus for Operating Dental Implements. Oscar H. Pieper and Alphonse F. Pieper, San José, Cal. Filed Apr. 30, 1894.

534,405. Electric Signaling Apparatus. Jonathan D. Price, Chicago, Ill. Filed May 5, 1894.

534,409 Car-Guard. Charles P. Stimpson, Troy, N. Y., assignor of one-half to Phebe R. Gunnison, same place. Filed Oct. 15, 1894.

534 411. Trolley-Wire Support. Marmaduke F. Van Buren, Philadelphia, Pa. Filed Oct. 5, 1894.

534 424 Reflector for Arc Lamps. Carl Coerper, Cologne, Germany. Filed May 15, 1894.

534,454. Conduit Electric Railway. Wilhelm Simon, Nuremberg, Germany. Filed Mar. 3, 1894. Renewed Jan. 11, 1895.

534,475. Conduit Electrical-Railway System. William L. Hedenberg, New York, N. Y. Filed June 5, 1894.

534,481. Electric Rotary and Revolable Air-Circulating Fan. Sherman M. Pierce, Kansas City, Mo., assignor of one-half to Chauncey S. Colton, same place. Filed Oct. 20, 1894.

534,485. Electric-Bell System for Street-Railways. Edward L. Stansberry and Jacob Bettinger, St. Louis, Mo. Filed May 7, 1894.

534,495. Conduit Electric Railway. Octavus Cohen, New York, N. Y., assignor to Rebecca O. Cohen, same place. Filed May 15, 1894.

534,519. Conduit Electric Railway. Alfred Rosenholz, San Francisco, Cal., assignor of one-half to Samuel J. Clarke and Harvey S. Brown, same place. Filed May 22, 1894.

534,528. Electrical Brush. Anson L. Sonn, Lansingburg, N. Y. Filed Oct. 15, 1894.

534,529. Electric Brush. Anson L. Sonn, Lansingburg, N. Y. Filed Sept. 24, 1894.

534,536. Electrically Operated Dental Engine. William E. Wheeler, Dayton, Tenn., assignor of one-half to George W. Johnson and James F. Johnson, same place. Filed Oct. 6, 1893.

534,547. Telephonic Apparatus. Norval I. Burchell, Washington, D. C. Filed Sept. 20, 1894.

534 586. Circuit Making and Breaking Device. Samuel W. Stratton, Chicago, Ill. Filed July 2, 1894.

534,595. Electrical Alarm or Bell. George F. Atwood, Orange, and Jonas W. Aylsworth, Newark, N. J. Filed May 28, 1894.

534,596. Electrical Conductors. George F. Atwood. Orange, and Jonas W. Aylsworth, Newark, N. J. Filed May 28, 1894.

534,597. Electrical Alarm for Street Cars. George F. Atwood, Orange, Jonas W. Aylsworth, Newark, and Walter H. Miller, Orange, N. J. Filed May 28, 1894.

534,603. Storage Battery. Geo. A. Ford, Cleveland, Ohio. Filed Aug. 11, 1894.

534,605. Trolley Wire Crossing. Charles S. Hersh and Edwin F. Weaver, Philadelphia, Pa., assignors of one-third to Alfred E. Clarke, same place. Filed May 13, 1894.

534,608. Tower Wagon for Electric Line Work. John H. Leonhardt, Baltimore, Md., assignor to the Leonhardt Wagon Manufacturing Company, same place. Filed Dec. 29, 1894.

534,613 Trolley Wire Support. Marcus T. Murphy, New Orleans. La., assignor of one-half to Robert Bensberg, same place. Filed Sept. 14, 1894.

534,617. Car Fender. Richard F. Preusser, Washington, D. C. Filed Nov. 7, 1894.

ELECTRICAL AGE

VOL. XV., No. 10. NEW YORK, MARCH 9, 1895. WHOLE No. 408

ESTABLISHED 1883.

Entered at New York P. O. as second-class matter, January 18, 1891.

THE ELECTRICAL AGE PUBLISHING CO., PUBLISHER

TERMS OF SUBSCRIPTION:

One Copy, one year,	$3.00
One Copy, six months,	1.50
Great Britain and other Countries,	4.00

Cable Address (all Cables,) "Electage," New York.

W. T. HUNT, President. F. N. BASSETT, Vice-President

T. R. TALTAVALL, Secretary and Editor.

NEWTON HARRISON, E. E., Scientific Editor.

ADDRESS ALL COMMUNICATIONS TO

THE ELECTRICAL AGE PUBLISHING COMPANY,

FIRST FLOOR, WORLD BUILDING.

NEW YORK.

NEW YORK, MARCH 9, 1895.

CONTENTS.

THE RATING OF ARC LAMPS.

The paper of L. B. Marks on carbons and the rating of arc lamps, which was read at the Cleveland convention last month, is a valuable contribution to the literature and general knowledge on the subject. The quality and size of the carbons have an important influence on the resultant illumination, and it is evident that the matter of carbons is one to be considered more carefully than is generally done. Prof. W. M. Stine has recently shown that there is a variation of 30 per cent. in light, according to the quality of the carbon used, and some years ago Mr. Marks himself, in a series of tests, found a variation of over 80 per cent. The more recent tests of Prof. Stine show an improvement, due of course to improvement in quality of materials used and manufacture. We give a full abstract of Mr. Marks' paper on another page.

THE A. I. E. E. AT NIAGARA FALLS.

The American Institute of Electrical Engineers will hold its general meeting this year at Niagara Falls. Electric power transmission will be the principal subject discussed. The meeting will commence on June 18, and a more appropriate place for it could not have been selected.

THE BATE DECISION.

The court of last resort in the United States has decided that an American patent expires with the first foreign patent on the same invention. This settles a question in patent law that has for many years been in dispute, and affects the status of many valuable patents, including some of the most important of those on electrical devices. Specifically, this was the decision of the United States Supreme Court, on March 4, in the Bate Refrigerator case, which has been before that court for several months, and which was argued on November 15, 1894. The decision of this case has been looked forward to with a great deal of interest and anxiety on account of its bearing on other patents. It finally settles the question of the meaning of Section 4,887 of the Revised Statutes, which has so long been a source of contention among patent lawyers. This section reads: "But every patent granted for an invention which has been previously patented in a foreign country shall be so limited as to expire at the same time with the foreign patent, or, if there be more than one, at the same time with the one having the shortest term, and in no case shall it be in force more than seventeen years." The Supreme Court holds that the wording of that section must be interpreted in its ordinary meaning, and that the intent of the section is unambiguous. It therefore decides that the Bate Refrigerator American patent expired when the first foreign patent on the same invention did. The history of the case is a long but interesting one. The Bell Telephone Company, the General Electric Company and other large concerns, appreciating the importance of the case, on account of its bearing on their own interests, championed the Bate cause, while the Westinghouse Company and the Harrison International Telephone Company led the opposition. That the decision is far-reaching is generally conceded. It affects several electrical patents of broad scope, including the Edison lamp patent, which has been the basis of so much litigation, and the three Edison transmitter patents owned by the Ameiican Bell Telephone Company. Of course there is no appeal from this decision. The main stay of many large property interests having been thus suddenly removed, will involve a readjustment of their business conditions and relations, but we have no doubt that those concerns most directly affected will come out all right in the end. The reawakening of competition will foster business, and there will be plenty for all to do.

POWER REQUIRED FOR ELEVATORS.

BY THOS. J. FAY.

In elevator practice there is much that needs attention, in order that the results may be satisfactory. To begin with, if we consider an elevator virtually a railroad, differing only to the extent that the elevator is at 100 per cent. grade, then may we more fully realize the difficulties to be overcome.

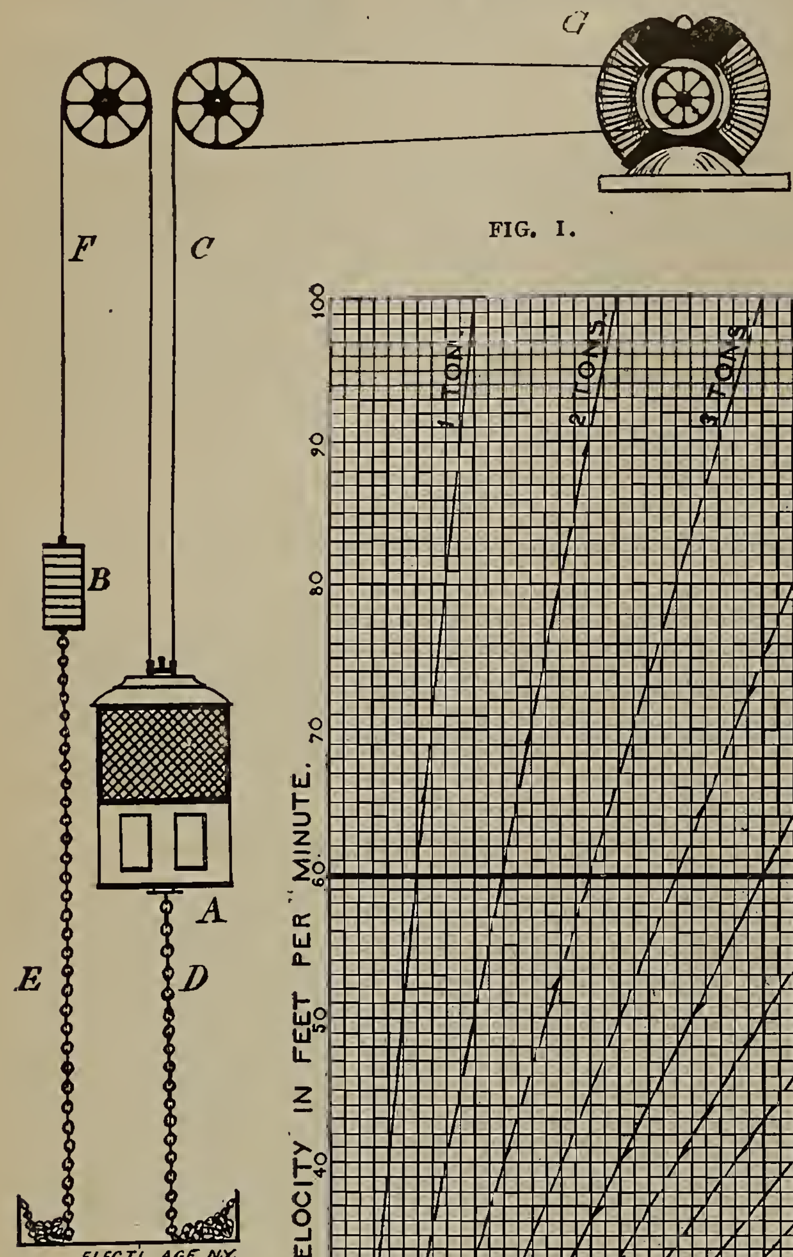
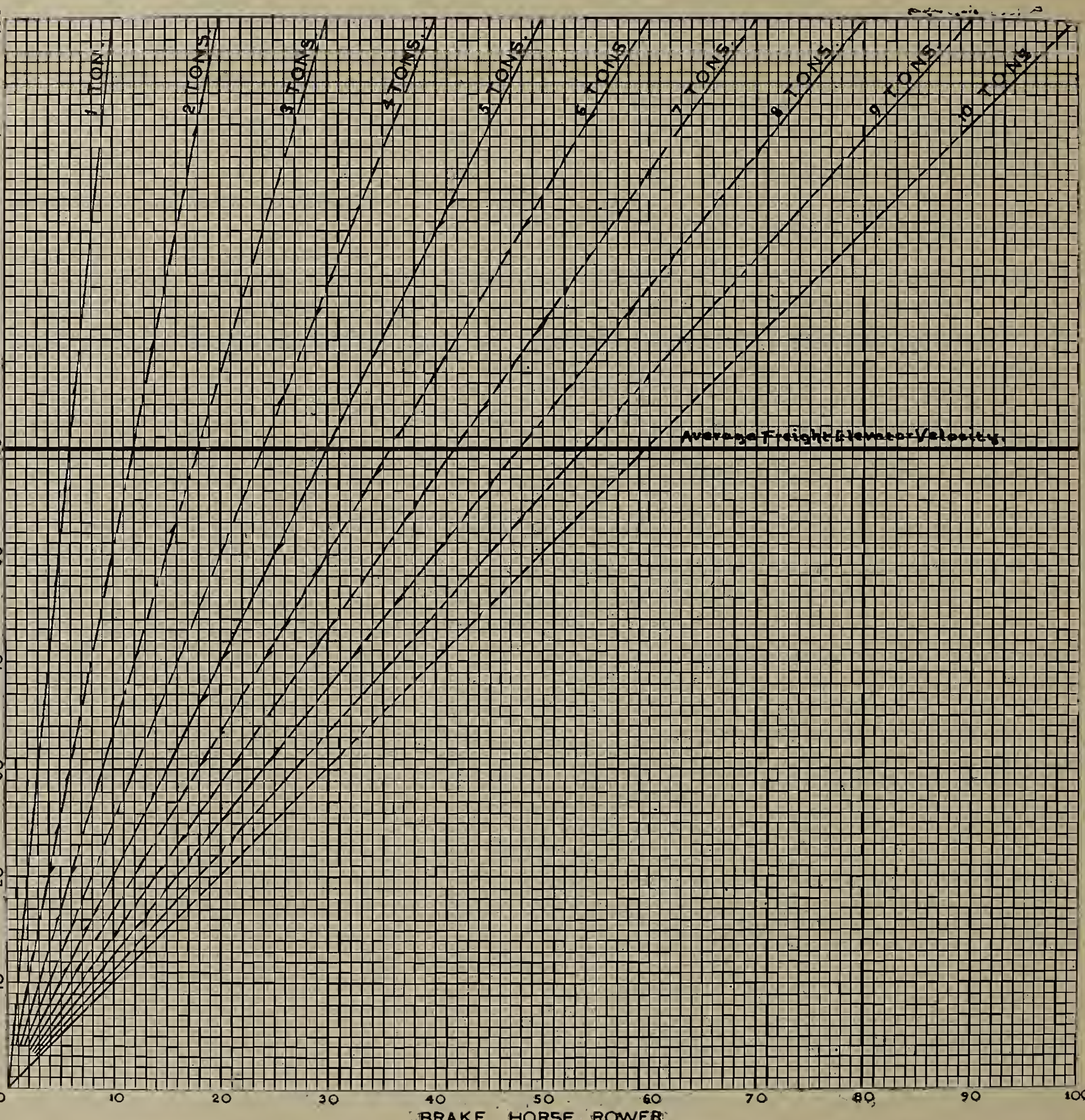


FIG. I.



POWER REQUIRED FOR ELECTRIC ELEVATORS AT 60 PER CENT. EFFICIENCY.

One of the principal troubles is to effect such an equalization of the moving bodies as to realize the maximum possible from the power applied; in order to do this, we must take into account the several factors entering into the problem.

Fig. 1 shows the general arrangement of the several parts constituting an elevator, in which A represents the car, B the counter-weight, C the hoisting cable, D the hoisting cable counter-chain, E the counter-chain for the counter-weight cable, F the counter-weight cable and G the motor set to actuate the elevator.

As regards the hoisting cable C, it is, as a matter of fact, variable as far as its effect on the power is concerned. When the car is at the bottom, the whole weight of the cable must be lifted, and the reverse is true when the car starts downward from the top. To counteract this variation in the weight, the counter-chain D is employed, and it is quite clear that the effective weight of the counter-chain D varies in an exact amount to equalize the variation in effective weight of the hoisting cable C, provided the weight per foot-length of the hoisting cable C and counter-chain D are the same. The same is true in the relation the counter-weight cable F bears to the counter-chain E, and as the counter-weight B offsets the weight of the car A, the only other considerations are the useful load and the friction of parts. The friction factor can only be reduced; we can not counterpoise it; and, on this account, machines should be constructed of good materials and in the best possible manner.

To sum up, we can tabulate the conditions and thereby effect a comparison :

	+	—
Weight of car A 5′ × 5′ × 40 =	1,000	
" " counter-weight B		1,000
" " cable C	100	
" " counter-chain D		100
" " cable F	50	
" " counter-chain E		50
Equivalent of friction	250	
Useful load	2,000	
	3,400	1,150

Counter effects 1,150

Weight to be elevated by motor 2,250 pounds.

Thus we may see, by the judicious use of counter-weights and chains, a total weight of 3,400 pounds is reduced to 2,250 pounds. It is doubtful, however, that in general practice so good results are attained. One reason for this is the fact that the counter-chain D, as before stated, is seldom employed, while the counter-chain E is never used, and it frequently happens that the cables in use are very long and heavy, thereby influencing the result considerably. We have in the above comparison determined that the net load to be elevated is 2,250 pounds. In order, however, to determine the power required to do this work we must take into account the velocity in feet per minute at which this weight travels. By the formula, at say 100 feet per minute velocity, we have

$$(1)\quad \text{H. P.} = \frac{W\,V}{33000} = \frac{2250 \times 100}{33000} = 6.79 \text{ horse-power;}$$

whereas, if no counter-weights were employed, the maximum power required would be,

$$(2)\quad \text{H. P.} = \frac{W + w \times V}{33000} = \frac{(2240 + 1150) \times 100}{33000} = 10.3 \text{ H. P.;}$$

from which we may assume that by the use of counter-weight and chains a net reduction in the size of the motor may be made of 3.57 horse-power.

In practice it is customary to assume a certain efficiency for the system, with a view to lumping the losses, and with a counter-balanced elevator (without chains) we may write the formula—

$$(3)\qquad \text{H.P.} = \frac{W \times V}{33000 \times Q}$$

In each of the above formula

H.P. = actual horse,power required,

W. = useful weight to be elevated,

w = equivalent in pounds of weight of car, cables and friction losses,

V = velocity in feet per minute,

$$Q = \text{efficiency} = \frac{\text{useful weight}}{\text{Total weight}} = \frac{W}{W + w}$$

Q = in average cases is about 60 per cent., and the chart (Fig. 2) is based on this realization of such net results. It is, therefore, considered that the chart is of good value, because it is "commercial," and one may feel sure in using it that he can make no greater error than to have a motor which may be a little large—a good mistake to make.

The method of using the table is simple, and hardly needs explanation; but for those who may not understand it, it may not be out of place to state that the diagonal lines represent weights in tons of 2,000 pounds to be elevated, and at any given velocity in feet per minute, the horse power required is ascertained by noting the point of intersection of the given diagonal with the horizontal line denoting the desired velocity, then following the intersecting perpendicular line down to the bottom of the chart, where the horse-power is given. For example, let it be desired to find the power required to elevate one ton sixty feet per minute.

An inspection of the chart will show that the horizontal line representing sixty feet per minute crosses the vertical line representing six horse-power at the point of intersection of the diagonal line representing one ton. In this way we find that six horse-power will elevate one ton sixty feet per minute at 60 per cent. efficiency.

CORRECT METHOD OF PROTECTING ELECTRIC CIRCUITS.*

BY W. E. HARRINGTON.

The use of fuses for the protection of electric circuits has proved unreliable and unsatisfactory. The adoption of magnetic circuit breakers being, as it is, a foregone conclusion, led the writer to make a study into the requirements entering into what would constitute a technically correct form of magnetic circuit breaker.

In a circuit entirely or partially inductive, a sudden increase of current is checked by the impedance of the inductive part of the circuit. The rise in current, with the time,

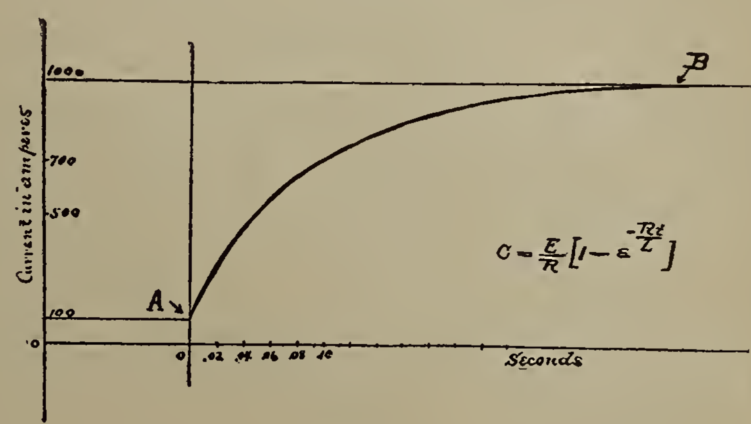


FIG. 1.

is illustrated by curve No. 1, taken from Bedell & Crehore's work on alternating currents.

This curve gives the rise in current, with time, in a circuit whose resistance is .1 ohm and coefficient of self-induction is .01 henry.

The curve is based on Helmholtz's formula—

$$C = \frac{E}{R}\left(1 - e^{-\frac{Rt}{L}}\right) \text{ wherein}$$

C = Current in amperes.
E = Applied electromotive force.
R = Resistance in ohms.
e = Naperian base of logarithms.
t = Time in seconds.
L = Coefficient of self-induction in henrys.

This is a logarithmic curve, and from the character of the formula, which is an exponential function, the practical interpretation has very seldom been appreciated by the practical operators of electrical apparatus. The utilization of the principle embodied in Helmholtz's formula gives the solution to the problem to determine the correct method of protecting electric circuits. The use of fuses for the protection of circuits has proved to be so antipodal to the fundamental principle contained in what is the severely technically correct method, that it is criminal almost, in the light of present practice, for users to follow like sheep in the path of their predecessors in the use of fuses. The

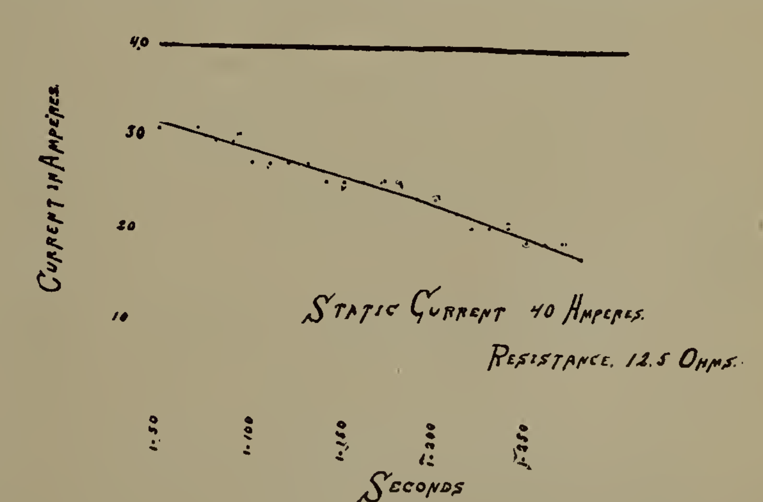


FIG. 2.

(Continued on Page 138)

*Read before the National Electric Light Association at its Eighteenth Convention, held at Cleveland, February 19, 20 and 21, 1895.

DECISION IN THE BATE REFRIGERATOR CASE.

VALUABLE ELECTRICAL PATENTS BECOME PUBLIC PROPERTY BY THE DECISION OF THE SUPREME COURT.

The United States Supreme Court on Monday, March 4, rendered its long-looked for decision in the Bate Refrigerator case. The court held that the Bate patent expired with the foreign patents.

The case is that of the Bate Refrigerator Company against Schwarzchild and Sulzberger of New York. The plaintiff brought suit in the Southern District of New York for infringement, and the bill was dismissed on the defendants' plea that a patent had been issued in England on the same invention between the dates of the application for and issue of patents in the United States, and that therefore the latter patent had expired with the English patent prior to the bringing of the suit. The case went to the Court of Appeals, which tribunal asked the United States Supreme Court to instruct it upon the question, in effect, "When did or when does the patent granted Bate in the United States expire?"

The Supreme Court heard arguments on November 15 last, and its decision is that the Bate United States patent did expire with the English patent.

It is estimated that not less than $600,000,000 of capital is involved by this decision, as it determines the status of many other valuable patents which will now fall.

The case involves the construction of section 4,887 of the Revised Statutes, which provides that "every patent granted for any invention which has been previously patented in a foreign country shall be so limited as to expire at the same time with the foreign patent, or if there be more than one at the same time with the one having the shortest term, and in no case shall it be in force more than seventeen years."

Among the patents affected are three issued to the Western Union Telegraph Company on applications filed by Thomas A. Edison, as follows: Patent No. 474,230, application filed April 27, 1877; Nos. 474,231 and 474,232, applications filed July 27, 1877. On March 7, 1893, patent 492,789 was issued to the same company on an application filed by Mr. Edison on Sept. 5, 1877. These inventions became the property of the American Bell Telephone Company by the telephone consolidation contract of Nov. 1, 1879. These Edison patents are claimed to be fundamental and they, with the Berliner patent now in litigation and which remained in the patent office from 1877 to November, 1891, expire at the date of the application of the foreign patents.

The inventions have been in use since 1878. The Edison inventions were patented abroad; in England, France and Canada in 1877; in Belgium, Austria-Hungary, Italy, Germany and Spain in 1878 and in Persia in 1882. They are free in foreign countries, and under the construction now given of section 4,887 are made free in this country. Substantially, the decision will affect in the same way the quadruplex telegraph patents which were applied for in October, 1874, and issued December 15, 1885. The incandescent lamp patents, owned by the General Electric Company, are also included in those which will be affected by the decision.

Judge Harlan rendered the decision, which was an exhaustive one, and there was no dissenting opinion.

The decision first reviews the present laws since the foundation of the government, tracing with minuteness the provisions as to foreign and domestic patents. It sums up the laws thus: "From this history of the several acts of Congress relating to patents for inventions, it appears,

1. That in all the above acts Congress had in mind the date of an application for a patent, the date of the filing of specifications and the date of the patent.

2. That under the act of 1836 a patent could not be granted if it appeared that the applicant was not the original and first inventor or discoverer, or that any part of that which was claimed as new had before been invented or discovered, or patented, or described in any foreign publication in use in this or any foreign country; yet an original and true inventor was not to be deprived of a patent for his invention by reason of his having previously taken out letters-patent therefor in a foreign country, and the same having been published at any time within six months next preceding the filing of his specification and drawings.

3. That, under the act of 1839 an inventor whose invention had not been introduced into public and common use in the United States prior to the application for a patent, should not be debarred from receiving a patent by reason of his invention having been patented in a foreign country more than six months prior to his application.

4. That under the act of 1870 an inventor whose invention had not been introduced into public use in the United States for more than two years prior to the application, should not be debarred from receiving a patent by reason of its having been first patented or caused to be patented in a foreign country—these words not being qualified—as in the act of 1839 by any reference to the date of the application.

5. That when an American patent was granted in conformity with the sixth section of the act of 1839 for an invention 'patented in a foreign country more than six months prior to his application,' it expired, in every case, at the end of fourteen years from the date or publication of such foreign letters-patent; and when, in conformity with the 25th section of the act of 1870, a patent was granted for an invention, first patented or caused to be patented in a foreign country, it expired at the same time with the foreign patent, or, if there be more than one, at the same time with the one having the shortest term.

6. That under the revised statutes, while a patent for an invention could not be withheld nor deemed invalid by reason of having been first patented or caused to be patented in a foreign country, unless the same has been introduced into public use in the United States more than two years prior to the application, yet, every patent granted for an invention previously patented in a foreign country shall be so limited as to expire at the same time with the one having the shortest term, in no case to remain in force longer than seventeen years.

The decision then takes up the legal contention of the plaintiff, that when the same invention is patented both in this country and abroad, the American patent remains in force for seventeen years from its date, if the foreign patent was issued after the application for, although prior to the date of the American patent. The interpretation placed upon the act of 1870 by the patent office and the courts is minutely considered and copious decisions cited, and the decision says: "This court may well adopt that construction which is in harmony with settled practice and decisions, especially if there be reason to suppose that vast interests may have grown up under that practice and under judicial decisions which may be disturbed or destroyed by the announcement of a new rule."

The decision then says: "Was the Bate invention patented abroad before it was patented in this country? If so, the American patent expired with the foreign patent, and thereby the American public became entitled to use the invention from the time the foreign public were permitted to use it. Congress in effect by the existing law says to an inventor seeking to enjoy the exclusive use in this country of his invention for the term prescribed by law: "If your invention has not been introduced into public use in the United States for more than two years, you may, upon complying with the conditions prescribed,

obtain an American patent and you may, if you can, obtain a foreign patent. But the American patent will be granted on the condition that if you obtain the foreign patent first, your invention shall be free to the American people whenever by reason of the expiration of the foreign patent it becomes free to people abroad; but in no case shall the term of the American patent exceed 17 years."

This we deem to be a sound interpretation of the statute giving to the words used the meaning required by their ordinary significance. In our judgment the language used is so plain and unambiguous that a refusal to recognize its natural obvious meaning would be justly regarded as indicating a purpose to change the law by judicial action based on some supposed policy of Congress.

The decision further says: "It is also said that the United States promised the inventor when making his application to give him a patent for the full term of 17 years from the date of his patent if, upon examination, it was found that he was entitled to one *at the time of such application;* and consequently a curtailment of that term by reason of something occurring after the filing of the application and for which he may not be responsible, is not consistent with good faith upon the part of the government. Of course, this court would hesitate to accept any construction of an act of Congress that would imply bad faith upon the part of any branch of the government. But the contention just referred to assumes the very matter in dispute. It assumes that the promise to the inventor was not accompanied by any condition authorizing the government to limit the term of its patent to some period less than 17 years from its date. If the promise to issue a patent is made with the reservation in the statute containing the promise that the patent when issued, should be limited to expire with any foreign patent previously issued for the same invention, then there is no basis for the suggestion that the enforcement of that condition violates any promise made to the inventor."

After disposing of numerous incidental points of the plaintiff, the decision proceeds:

"A good deal has been said about the intention of Congress as manifested by its legislation, to deal liberally with inventors, especially those who were citizens of the United States. That is true, but it is for Congress to prescribe the conditions upon which it will secure to inventors the exclusive right to their inventions. What may be due to inventors is a matter about which there may well exist differences of opinion. It is the province of the legislative branch of the government to say when a patent to an inventor shall expire, and therefore when the public may enjoy, without charge, the benefit of the invention covered by it. We can very well understand how the existing statute may in some circumstances operate injuriously to an American inventor, who in addition to the exclusive rights granted to him in this country for the term of 17 years wished to secure a monopoly for his invention before obtaining one here. The American patent is limited by law, whether it is so expressed or not in the patent itself, to expire with the foreign patent having the shortest term. This is the case as it appears from the standpoint of the patentee without regard to the interests of the American public."

"We need not say whether these considerations were or were not sufficient to induce the change made by the 25th section of the act of 1870 and by the existing statute. They are referred to only as showing what Congress may have had in view when it provided, as it did, that an invention covered by a foreign patent which the inventor obtained or caused to be obtained before receiving an American patent should be free to the American public as soon as it became free by reason of the expiration of the foreign patent to people of other countries. If this principle operates harshly upon inventors in certain cases, it is for Congress, whose discretion is not subject to judicial control, to make provision for those eases, if it be possible to do so without such injury to the people of our country as ought not to be inflicted upon them.

"The rule prescribed by the 25th section of the act of 1870 having been reproduced in section 4,887 of the Revised Statutes and the latter section never having been amended, we ought not, after the lapse of nearly twenty-five years from the passage of the act of 1870, place upon its 25th section, or upon section 4,887 of the Revised Statutes which took its place, any interpretation other than that which the ordinary natural meaning of their words import. Our answers, therefore, to the questions certified are, that the invention for which United States patent to Bate was issued was, under the facts stated, "previously patented in a foreign country," within the meaning of those words in section 4,887 of the Revised Statutes, and that the United States Patent to him expired under the terms of that section before the expiration of seventeen years from its date."

WHAT IS ELECTRICITY?

BY DAVID FLANERY.

The article "What is Electricity?" by Mr. Walker, which appeared lately in your valuable journal, is ably written and scientifically interesting. The same explanation, however, was given 30 years ago, and although it was more attractive at that time because of the laws of motion and the correlation of forces were not as well understood then as now, it was just as vague as it is at present. In short, to say that electricity is a mode of motion is only begging the question, for another question naturally follows—"Motion of What?" We are surrounded by motion on all sides; in front, in rear, on either side, above and below us in an infinite variety of forms, there is nothing at rest except in a limited relative sense. The rejoinder by one party is—"Motion of the ether," and by another party, a molecular motion of matter—that is, ponderable matter. But the trend of recent science is to show that molecules of matter are composed of the atoms of ether, and in the correlative force—light—it is now shown that in the absence of matter there is no light. Dust in the atmosphere is an essential condition of our seeing, and it may be said of light just as I said of electricity nearly 20 years ago, that it is a concomitant of matter and inseparable therefrom. And we appear to be as far behind in our knowledge of light after all that has been said and done to give an exact and intelligent explanation of it as we are in our knowledge of electricity. It is not clear whether either force is due to a motion of the ether or a motion of matter. It has been said recently that science is bankrupt; but this is not true of physical science, for though at times it may appear to be at a stand still it is only the rest which takes place at a change of direction of motion and is suggestive of the darkness which precedes the dawn. We are on the eve of a great addition to our real knowledge, and until the coming light shines in upon us nothing more definite can be said. When that light does come it is doubtful whether an ultimate answer to the question "What is Electricity?" can be given, for it is evident to any one of ordinary capacity that nature has mysteries which it is intended shall not be shared with man until he passes into the light of another world. Still man should keep trying.

THE TACOMA AND PUYALLUP RAILWAY.

The Tacoma Traction Co., of Tacoma, Wash., will build a new power house to cost from $60,000 to $75,000. This company will equip the Tacoma and Puyallup Railway Co. with electricity generated from the new power house. This railway extends from Puyallup Junction to Puyallup, a distance of 12 miles. All of the machinery for this plant has been ordered.

The new equipment of rolling stock to begin with will consist of five or six 22-foot double truck high speed cars. It is proposed to maintain a high speed service on this line. The new power plant will have a capacity at the start of 400-H. P. and the road is to be equipped in a first-class manner in every way. Mr. J. P. Clark is general manager of the line and is a wide-awake gentleman. The officers of the company are: President, L. H. Hale, of Chicago; First Vice-President, W. N. Coler, Jr., of New York; Second Vice-President, C. S. Fogg, of Tacoma; Secretary, Geo. B. Blanchard, of Tacoma.

(*Continued from page 135.*)
practical interpretation of the above formula indicates clearly that if a circuit be opened during the rise or first surge in current upon a tendency for abnormal flow, and further, if the time of opening be made as quickly as possible, the less the resulting flow of current will be.

To realize the importance of this time element in the opening of a circuit, if we refer to curve No. 1, it is apparent that if the circuit were opened in $\frac{75}{100}$ of a second, the current would be only ½ the strength it would be if allowed to flow until it had reached the volume due to ohmic resistance alone.

It will also be noticed that if the circuit were opened in

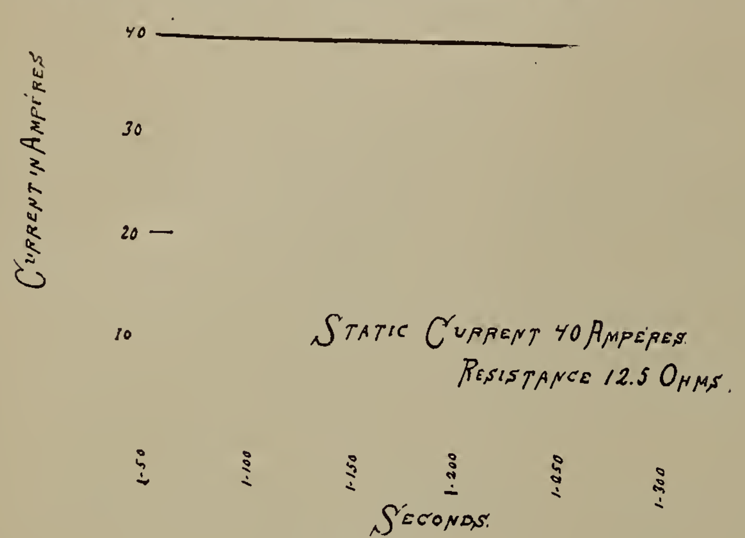


FIG. 3.

$\frac{2}{100}$ of a second, the current would be about $\frac{1}{6}$ its final value.

To eliminate mathematics, and that most elusive of all electrical units to grasp, the henry, and to illustrate it in every-day amperes the effect time has upon opening a circuit in a working power-station, wherein exists the self-induction of the dynamos and station appliances, and the small negligible self-induction of the measuring instruments used in testing—tests were made in the power-station of the Camden Horse Railroad Company, as follows:

In order to vary the current for making the tests, a non-inductive resistance, to wit: a water rheostat was employed. The use of a non-inductive resistance for varying the current would not introduce factors to prevent the results from representing what would actually occur upon corresponding changes in condition of circuits with time such as would occur in practice. In fact, in the majority of in-

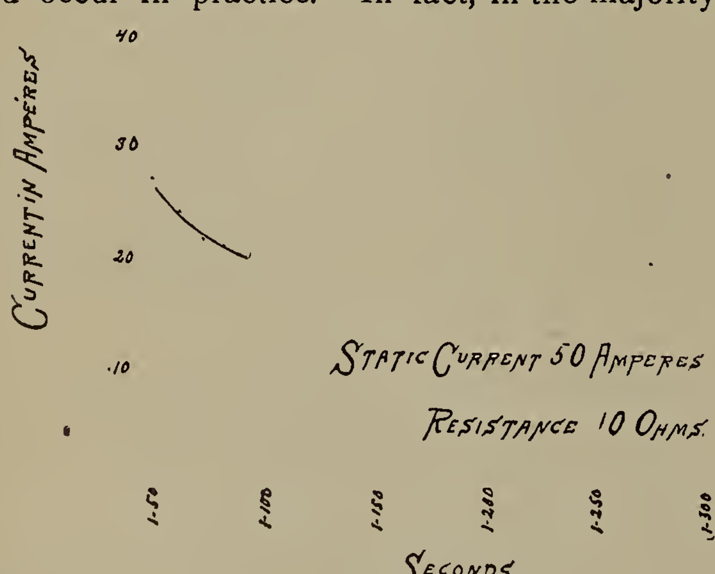


FIG. 4.

stances, the results would be even more pronounced than those shown in tests, as there would usually be inductive resistances in circuits.

Fig. 7. A vertical iron rod having a sliding contact dropping from different heights and making contact with a fixed wiping contact, completed a circuit for varying but predetermined periods of time, dependent upon position of sliding contact before dropping.

By carefully calibrating the device for the time of contact by the sliding contact, using the fundamental law of gravitation.

$$t = \sqrt{\frac{2\,h}{g}} \text{ whence}$$

t = Time in seconds.
h = Height of fall in feet.
g = Acceleration due to gravity = 32.2 feet.

A means was thus at disposal for determination of time for making of circuit for $\frac{1}{50}$ of a second to $\frac{1}{280}$ of a second in steps as follows: $\frac{1}{50}$, $\frac{1}{60}$, $\frac{1}{30}$, $\frac{1}{80}$, $\frac{1}{280}$ of a second.

A Weston standardized ammeter was employed for adjustment. By placing the sliding contact to touch the fixed wiping contact, a circuit was completed through an

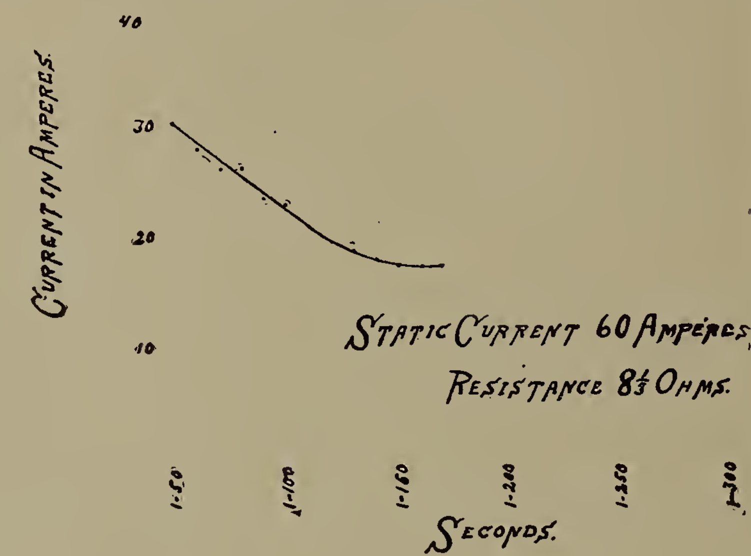


FIG. 5.

adjustable water rheostat, permitting the flow of a predetermined current, after which circuit could be opened by an auxiliary switch. The sliding contact could then be set at a point, by dropping from which the time for completing circuit was as desired. In circuit was a carefully calibrated C-S magnetic circuit breaker, used as an ammeter and subject by adjusting screws to open on different currents. By letting sliding contract drop a sufficient number of times to find the adjustment of the C-S magnetic circuit breaker which the current flowing would not open, also the adjustment at which the current would open it, gave a means for knowing conclusively that the current actually flowing would be between the two indications of the circuit breaker. By continuing this operation for the same static current for the different periods of time within the limits of the testing device, the series of value thus ob-

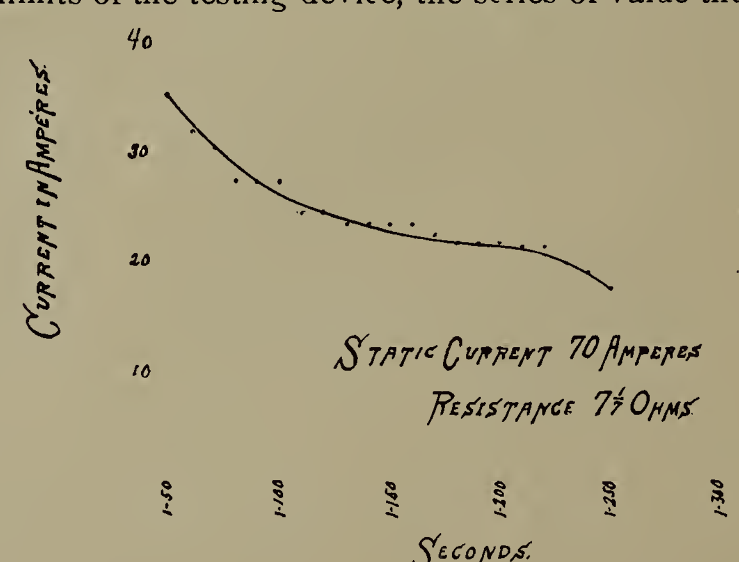


FIG. 6.

tained could be plotted out, showing graphically the differences between the current which would flow for continued periods of time, due to the applied electromotive force and the given ohmic resistance of the circuit, and the current which actually flows for the very short period of time established by the wiping contact. The effect of impedance is illustrated so excellently for a continuous circuit having an initial voltage of 500-volts, with currents ranging from 40 amperes to 70 amperes and in 10 ampere steps, that it will appeal at once to all as a striking object lesson. Figs. 2, 3, 4, 5, 6, show clearly the impedance effect.

Fig. 2 illustrates the values of current for the different periods of time current can flow, ranging from $\frac{1}{280}$ second to $\frac{1}{50}$ second, when the ohmic resistance of the circuit is 12.5 ohms.

This test was made without any effort to overcome the arcing attendant upon opening the circuit.

Fig. 3 illustrates the values of current under similar conditions as illustrated by Fig. 2, except that an air blast was employed to blow out the arc following the opening of the circuit. The difference in eighteen results obtainable between tests two and three in the use of an air blast was

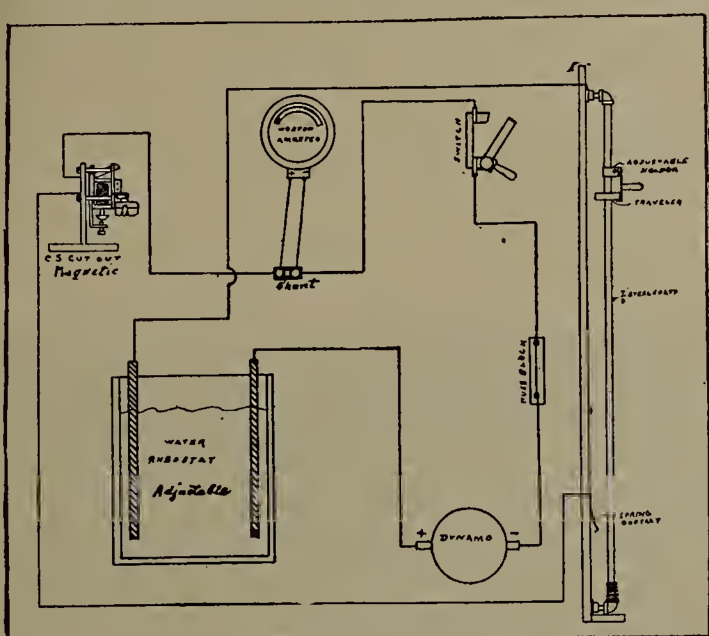


FIG. 7.

so pronounced that is was employed in the remainder of the tests.

Figs. 4, 5 and 6 are curves illustrative of tests when the ohmic resistance of the circuit was respectively 10, 8.3, 7.1 ohms.

To appreciate the meaning of the curves, the full black line is the line showing the value of current if the circuit be closed for any extended period of time; the difference between the straight heavy line and the curved line shows clearly the effect the time of opening a circuit has upon a typical power plant.

The heretofore standard form of magnetic circuit breaker and the type familiar to all, is immeasurably preferable to fuses, in so far as it opens the circuit much quicker on the score of time. Fuses open the circuit so late after the heavy unusual condition of circuit is established that the current reaches the high and parallel part of current curves.

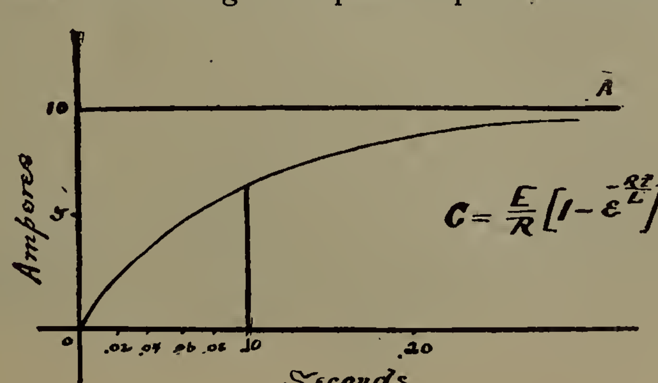


FIG. 8.

For illustration, curve No. 8, in which we assume current has been flowing at, say, 100 amperes, with a 150 ampere fuse to protect the circuit, suppose a short circuit occurs, making a condition wherein 1,000 amperes would flow owing to ohmic resistance, if not checked.

The fuse would not blow until the current had at least reached point B on curve, or some point beyond. The ideal point to open the circuit should be as near the point A as would be possible.

While the regular well-known types of magnetic circuit breakers open before fuses do, still they are not what they should be, when the heavier, more abnormal short circuits occur on circuits, for the reason that the magnetic circuit breakers as at present constructed have practically an unvarying fixed time element; that is, they open in the same time whether the condition of circuit be such as to just permit the passage of current required to open the circuit breaker, or the condition of circuit be such that the passage of current is due to a short circuit.

The opening of the magnetic circuit breaker, as constructed, depends either on springs or gravity; the role the magnetic feature plays is simply to allow either the spring or gravity to act on the switch.

A magnetic circuit breaker should be constructed to open the circuit in less and less time as the conditions become more and more severe. This can be done by taking advantage of the flux of lines of force due to the passage of the current, since, fortunately, the two are simultaneous; and by designing the magnetic circuit breaker to open as regards time in an inverse ratio to the increase of the lines of force, and not depending on the springs of gravity, except, possibly, as auxiliaries to act as potential energy to aid in overcoming the inertia of the switch jaws and arms. We have then the correct method of protecting electric circuits.

The destruction of electrical apparatus, the breaking down of insulation, the burning out of circuits, is taken by the business managers of electrical stations with a meekness and a non-effort for relief which is astonishing. What business manager would permit his boilers to run with safety-valves of such a type that an increase of 500 to 1,000 per cent. of pressure would be required to open them?

The writer has repeatedly made tests showing that a No. 21 B. and S. gauge copper wire would permit the passage of 450 amperes for $\frac{3}{100}$ of a second without burning out, without changing color. This is significant, as it shows that under conditions in practice the mechanical shock or torque tending to wrench or rupture insulation would be present in a marked degree, and further faults and flaws would develop which would by recurrence eventually cause the break-down in insulation. Owing to the sluggishness of fuses, permitting current to rise to the level point of current curve, wires under insulation in machines, as well as building wiring, unquestionably at times become red hot. I have seen wires become heated momentarily red hot, and cool off immediately after current was checked.

How many unknown, mysterious fires have started from this cause in electric wiring circuits?

All switchboards and minor lighting circuits should be protected by automatic (as regards time element), magnetic circuit breakers, and the urgency of this will appeal to the exchequer of the management of our many electric light and power stations when the full meaning and import of Helmhozl's law dawns upon them.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

At the meeting of the Institute held at 12 West Thirty-first street, New York, in the evening Mr. H. Ward Leonard presented a paper entitled "Notes on Recent Electrical Engineering Developments in France and England." The paper was discussed by Messrs. Townsend Wolcott, J. W. Lieb, Jr., C. E. Emery, Herbert Lloyd, A. E. Kennelly, Wm. Maver, Jr., M. W. Forney, Cary T. Hutchinson, Richard Fleming, Joseph Sachs, Professors F. B. Crocker and E. J. Houston.

At the regular monthly meeting of the Council held February 27, it was voted that the general meeting of the Institute be held at Niagara Falls, beginning on June 18.

It is proposed to devote this meeting principally to the question of power transmission.

The following associate members were elected:

Anson, Franklin Robert, manager Salem Consolidated Street Railway Co., Salem, Ore.

Cumner, Arthur B., Cumner, Craig & Co., 69 Broad street, Boston, Mass.

LeConte, Joseph Nisbet, instructor in electrical engineering, State University, Berkeley, Cal.

Loewenherz, Hermann, mechanical engineer, Met. Tel. and Tel. Co., 18 Cortlandt street, New York City.

MacCulloch, Robert C., manager Joseph Lough Electric Co., 503 Fifth avenue, New York City.

Mayer, Maxwell M., manufacturer of dynamos and motors, 411 107th street, E. R., New York City.

Nyhan, J. T., superintendent and electrician, Macon and Indian Spring Electric Railway, Macon, Ga.

Paddock, B. C., Jr., assistant in generating department Edison Electric Illuminating Co., of Boston.

Prince, J. Lloyd, engineer Brooklyn (N. Y.) Water-Works, Flatbush, N. Y.

Redman, Geo. A., general superintendent Brush Electric Light Co. and Rochester Gas and Electric Co., Rochester, N. Y.

Swenson, Bernard Victor, instructor in electrical engineering University of Illinois, Champaign, Ill.

The following associate members were transferred to membership:

Crosby, James Wellington, electrical engineer, Hix, Crosby and Co., New York City.

Hix, E. Randolph, Hix, Crosby & Co., New York City.

Billberg, C. O. C., electrical engineer, Thos. H. Dallett & Co., Philadelphia, Pa.

Craig, James Hally, Cumner, Craig & Co., Boston, Mass.

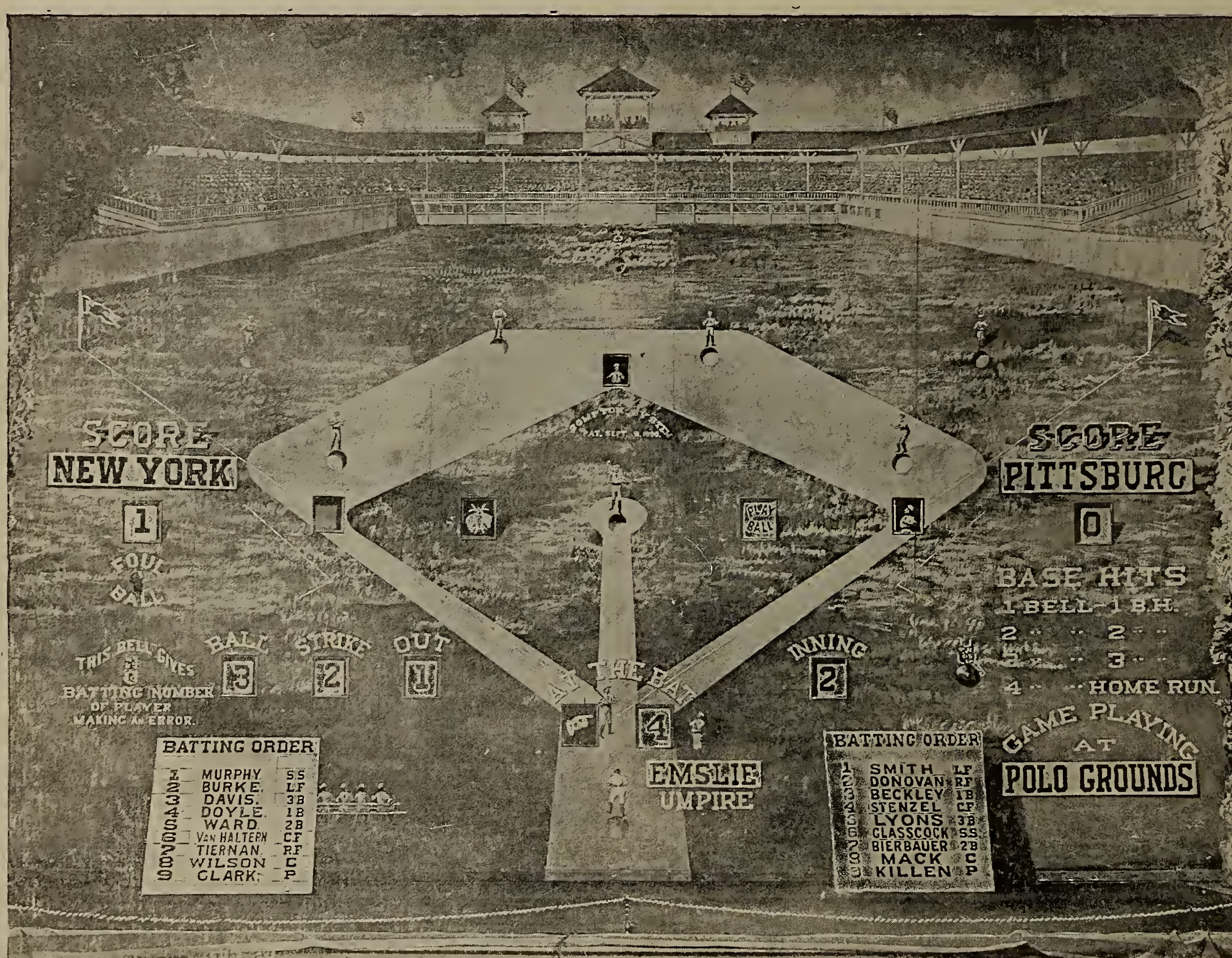
Shaw, Edwin C., manager Akron General Electric Co., Akron O.

BASEBALL GAMES BY ELECTRICITY.

Interest in baseball is beginning to revive, and there is every indication that the coming season will be one of great enthusiasm in the baseball world.

There are thousands of votaries of this fascinating game who are prevented from witnessing the plays on account of distance, and must be content with reading of the results on bulletin boards and in the papers. But electricity has come to their aid, and by its agency interested persons can witness a reproduction in their own town of their favorite game played hundreds of miles away.

This interesting method of reproducing a game of baseball at a distance is illustrated herewith. The scene represents the baseball grounds, and pictures of the players are painted at the respective positions occupied by the side that is in the field. Beneath these pictures are round openings in the scene about five inches in diameter. Behind these openings appear the colors, "white," when one club is in the field, and "green" when the other is in the field. Numerous other openings are in the scene, behind which electric motors bring to view pictures and figures, which instantly indicate a "ball," "strike," "foul," "error," and by whom made, "base-hits," the number of inning being played and the score of each respective side. The man at the bat is instantly indicated, so that the moment a player steps to the bat the audience immediately knows his name, and each and every decision of the umpire as to "fouls," "balls," "strikes," etc. After he advances



COMPTON'S SYSTEM OF REPRODUCING GAMES OF BASEBALL.

from the plate, after making a "hit," the audience sees him appear at first, second and third base, and so on, until he scores or is put out, and is instantly informed the moment either event occurs. The whole system is controlled by a keyboard, which is located in the orchestra in front of the scene, where a telegraph operator sits at his instrument, with a direct wire to the ball-ground, and as the plays are flashed to him over the wire, he simply presses the proper button and the "play" is reproduced before the audience within five seconds, just as it takes place at the scene of action.

The reproduced games are remarkably realistic, and Mr. M. D. Compton, the inventor of the system, made a great hit in Baltimore and Washington last season during the final struggles for victory on the diamond. The Baltimore

club, it will be remembered, won the championship pennant, and so successful was Mr. Compton's work in reproducing the last games that he was warmly congratulated by all interested.

Mr. Compton's office is in the Postal Telegraph Building, New York City. He is the inventor of other electrical devices of great merit, including the well-known electric system for automatically controlling temperature in rooms.

ANOTHER NEW LAMP.

If the claims made for the new A. B. C. lamp are correct, it has a perfection not reached in the production of lamps of any other make.

Heretofore, long life has been only possible by producing lamps of low efficiency, while modern practice requires lamps of high efficiency, sustained life and candle-power.

The claim for the new A. B. C. covers the latter ground in its entirety which is more than borne out by the number of severe tests that have been given it, and by the fact that it consumes less current than any other lamp on the market today. Sixteen c. p. lamps at 110 volts are made to pass either .4 or .5 of an ampere of current, and when special long life is desired, to pass .55 of an ampere, and lamps are made to suit individual requirements.

FIG. 1.

The sagging of filaments is entirely overcome and the new A. B. C. may be placed in any position without detriment in this respect.

We have had the pleasure of seeing the new A. B. C. in two different plants in New York city, among the first put out some time last fall, giving today full brilliancy with the utmost uniformity throughout. Each lamp is accurately measured and carefully tested thirty minutes before leaving the factory. The best of material is used throughout, and nothing is too good to go into the A. B. C. The glass is clear, the base solid and the workmanship thorough.

A guarantee is given that the four-watt lamp will average a life of 1500 hours; 3½-watt lamp 800 to 1,000 hours, and 3-watt lamp 600 to 800 hours.

As shown in Fig. 1, which represents the regular 3½ and 4-watt lamp, the filament is in spiral form, giving by this means a good-sized surface of carbon in a small globe. The material used for the purpose is one selected after long and tedious experiments to get the proper substance for long life and brilliancy, together with freedom from blackening.

Fig. 2 represents the special railway lamp. This lamp is made with the double coil filament, no anchor being needed.

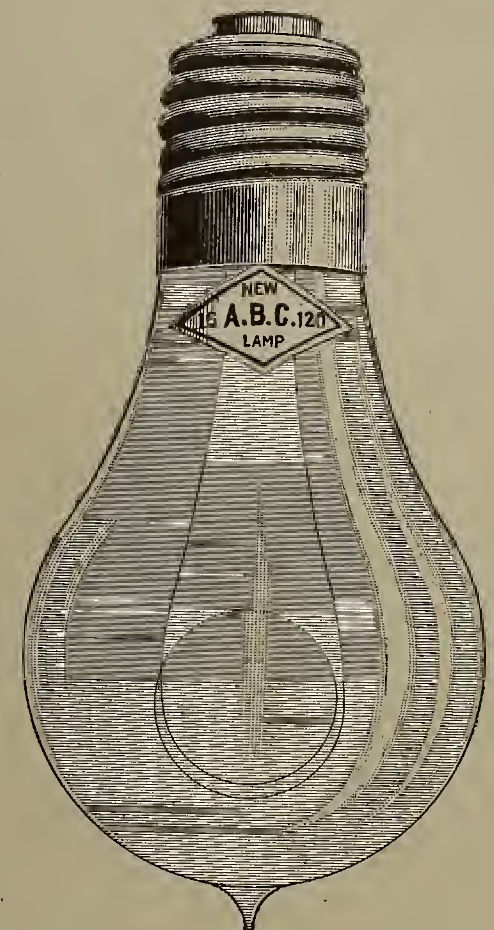


FIG. 2.

All styles of lamps are being made, from battery lamps up.

J. Jones & Son, 67 Cortlandt street, New York city, are the manufacturers of this excellent lamp.

NOTES ON RECENT ELECTRICAL ENGINEERING DEVELOPMENTS IN FRANCE AND ENGLAND.*

BY H. WARD LEONARD.

ALTERNATING CURRENT PRACTICE.

In England one of the first things which impresses an engineer is the total absence practically of a 50-volt secondary for alternating systems. It is the general practice in England of late to use a three-wire secondary with 100 volts on each side. I believe that every engineer who has ever given the subject a thought, knows that there was no excuse except patents for a 50-volt two-wire secondary originally, and no excuse except the inertia and prejudice of large corporations for continuing to put in the two-wire 50-volt secondary today.

MANUFACTURING AND ENGINEERING.

In England there is a multitude of medium size concerns manufacturing electrical apparatus, and the competition is mainly on ideas, and not the cost of dynamos per kilowatt. It is surprising to find that generators and motors are much cheaper in the United States than in either England or France, notwithstanding their advantages over us as to cheaper raw materials and labor.

* Abstract of paper read before the American Institute of Electrical Engineers, New York and Chicago, February 27, 1895.

ROTARY TRANSFORMERS.

Rotary transformers are used in several stations in England for a continuous current high potential multiple arc distribution, the secondary being a three-wire systems a usual. Such a plant is in use at Oxford. At Brighton and several other places the standard 220-volt continuous current three-wire system is supplemented for distant lighting and in newly occupied territory by the alternating system, using about 2,000 volts in the primary and a 220-volt three-wire secondary.

This alternating plant supplies the distant and scattered lighting during the period of heavy load, and during the period of light load (about three-quarters of the whole time) this distant lighting is supplied directly from the 220-volt three-wire system by switching the secondary circuit from the converter to the regular three-wire system.

STEAM ENGINES.

I believe we are ahead of England and France in the designing of dynamos and engines. Their workmanship leaves nothing to be desired, but giving consideration to amount of material used, efficiency and design, I think we are in advance of them.

THE PARSONS STEAM TURBINE.

The Parsons steam turbine was one of the most interesting things I saw in England. These steam turbines are direct coupled to dynamos, and in sizes of 350 K. W. revolve at 3,000 revolutions per minute, and of course run at higher speed in smaller sizes. The space occupied by a 350 K. W. outfit is over all about 25 feet long, five feet wide and including governor about seven feet high. These turbine plants when running at these high speeds are entirely free from vibration and are not even bolted down, but are supported by three pedestals, one near each end and one at the middle. There are some seven or eight bearings all in line, and a continuous stream of oil is forced through the bearings by a small pump driven by a worm on the main shaft.

Tests by Professors Ewing and Kennedy indicate that this turbine when in perfect condition has an efficiency of one K. W. hour in electrical energy produced by 28 lbs. of feed water, the turbine being operated condensing. This is equivalent to about 15.7 pounds of water per indicated horse-power per hour, and I understood that in a recent competition a guarantee was made by Mr. Parsons which was equivalent to about 13 pounds per indicated horse-power per hour, and that his guarantee was lower than that of the best triple compound condensing engines of the reciprocating type which were in the competition. At Newcastle-on-Tyne I saw a central station of about 25,000 lights operated solely by these steam turbines, and which has been in operation since 1890, and has been earning and declaring dividends ever since it started. An interesting fact as to this Newcastle station is that all of the conductors are laid underground and consist of vulcanized rubber cables drawn into cast-iron pipes which are gas and water tight, and through which chemically dried air is forced from the station by a blower.

There are over six miles of piping and over 25 miles of cable, and after five years operation Mr. Parsons states that they have not had a single instance of failure of insulation, explosion or other trouble with the underground system.

THE BROOKLYN HEIGHTS RAILROAD COMPANY'S CHARTER.

Attorney-General Hancock, of New York State, on February 14, denied the application brought by the Brooklyn trolley strikers to vacate the charter of the Brooklyn Heights Railroad Company, on the ground of alleged violation of the ten-hour law. He does not consider the facts presented by the petitioners sufficient to justify the bringing of an action to annul the charter of the corporation. Attorney-General Hancock also denies the petition to commence actions for the removal of the president of the Atlantic Avenue Railroad Company and the president of the Brooklyn Heights Railroad Company for alleged violation of the ten-hour law. The charges are not proved by legal evidence, he says.

ARC CARBONS AND THE RATING OF ARC LAMPS.*

BY L. B. MARKS.

It is, of course, well known that the so-called 2,000 candle-power are really given a mean candle-power of only 300 to 600, the candle-power at the angle of maximum illumination seldom being greater than 1800, and often as low as 700. In an elaborate series of comparative tests made by the writer several years ago there was found to be a variation of over eighty per cent. in the candle-power of commercial arc-light carbons consuming the same energy. Quite recently, Prof. W. M. Stine† has reported on a number of tests, the results of which show a variation of about thirty per cent.

The difference in the quality of arc carbons is well brought out in the following table, in which values are given for the hissing point, and the flaming point of various American and foreign products respectively:

Arc Carbons and the Rating of Arc Lamps.

By L. B. MARKS.

Number.	Structure.	Diameter, (Inches.)	Basic Material.	Process of Manufacture.	Hissing Point. (Volts.)	Flaming Point. (Volts.)	Range. (Volts.)
1	Solid	½	Petroleum Coke	Molded	43.6	71.3	27.7
2	Solid	½	Petroleum Coke	Molded	48.2	79.0	30.8
3	Solid	7/16	Petroleum Coke	Molded	45.7	79.7	34.0
4	Solid	15/32	Petroleum Coke	Squirted	51.3	62.7	11.4
5	Solid	½	Petroleum Coke	Squirted	47.3	75.0	27.7
6	Solid	½	Lamp Black	Squirted	47.2	70.8	23.6
7	Solid	7/16	Lamp Black	Molded	43.0	67.3	24.3
8	Solid	7/16	Lamp Black	Squirted	43.7	76.8	33.1
9	Solid	7/16	Gas Black	Squirted	46.	70.7	24.7
10	Solid	7/16	Gas Black	Molded	41.3	74.3	33.0
11	Solid	7/16	Not Ascertained	Squirted	41.7	75.3	33.6
12	Solid	7/16	Pure Coke	Molded	53.7	73.7	20.0
13	Solid	7/16	Pure Coke	Molded	52.0	71.5	19.5
14	(+), 1/16 hole (—), solid	½	Petroleum Coke	Squirted	42.8	60.7	17.9
15	(+) cored (—), solid	(+), 9/16 (—), ½	Petroleum Coke	Squirted	35.0	61.7	26.7
16	(+), cored (—), solid	½	Petroleum Coke	Squirted	31.3	58.7	27.4
17	(+), cored (—), solid	(+), ½ (—), 7/16	Not Ascertained	Squirted	31.3	70.7	39.4
18	(+), cored (—), solid	7/16	Not Ascertained	Squirted	32.3	66.3	34.0
19	(+), cored (—), solid	(+), ½ (—), 7/16	Not Ascertained	Squirted	31.7	71.3	39.6

In order to determine these values a pair of carbons was placed in a lamp and burned for twenty to thirty minutes. After the point had been well formed, the carbons were gently brought together until the arc hissed. A voltmeter connected to the terminals gave the potential difference. The lamp was then adjusted for a silent arc and the mechanism so arranged that the rod was held rigidly. The carbons were then allowed to burn away until they flamed, the voltmeter being carefully watched meanwhile. Before the flaming point was reached, the instrument would invariably fluctuate, due to "jumping" of the arc. At the flaming point there was a marked drop in the potential, as indicated by a voltmeter. Great care was taken to

* Abstract of paper read at the Convention of the National Electric Light Association, Cleveland, O., Feb. 19–21, 1895.

† W. M. Stine: "Influence of Arc Light Carbons on the Candle-Power." N. Y. *Electrical Engineer*, October 3, 1894. See also *Elec. World*, Feb. 23, 1895.

‡ L. B. Marks: "Light and Efficiency of Arc Light Carbons." Transactions American Electrical Engineers, Vol. VII., Nos. 6 and 7, 1890.

secure perfect alignment of the upper and lower carbons.

The results given in the table are an average of three different tests of each pair of carbons. The carbons were all intended for a current of from eight to ten amperes, nine and one-half amperes being used in the tests. The total length of a pair of carbons was ten inches in each case.

The amount and nature of foreign matter in a carbon have much to do with the commercial efficiency of the latter, and determine to a large extent the range of the carbon.

It has been the desire of central station men to obtain, and the aim of the manufacturer to produce, an absolutely pure petroleum coke carbon, thinking that this would, in a large measure, solve the candle-power question so far as uniformity is concerned. The writer is of the opinion, however, that an absolutely pure coke carbon, if such could be commercially manufactured for arc lamps, would not meet the requirements of central station practice today. Carbons 12 and 13 (see table) are taken from two batches made with special reference to purity. It will be noticed that one of them hissed at 53.7 volts and the other at 52.

To be operated at maximum efficiency, these carbons would require more than 55 volts at normal current, and under no conditions in practice would they give satisfactory service at less than 55 volts average—fully five volts higher than that of good commercial carbons.

Thus, it is of the utmost importance to the carbon manufacturer to test not only the range of his carbons, but also the voltage at which they give maximum efficiency. The importance of steadiness in arc lamps has been very well shown by the introduction of cored carbons. Here, again, we are confronted with the question of candle-power in relation to the consumption of energy. If we assume that a 450-watt arc gives nominally 500 candle-power with efficient solid carbon sticks, we must make an allowance of at least from 15 to 30 per cent. for reduction in candle-power for the same energy substituting an efficient cored carbon stick. Yet, for indoor illumination, the consumer is better satisfied with the cored carbon than with the solid.

Reference has already been made to current density. It would be entirely out of the question to designate a given current density for commercial light carbons, yet, in attempting to formulate a relation between candle-power and energy expended in the lamp, the question of current density must necessarily be considered.

When we consider that, as a means for securing long life, flat carbons and "twin" carbons have been more or less used, we are reminded that in connection with the available candle-power per watt expended in the arc lamp, the shape of the carbon must be given due consideration.

A consideration of alternating current arcs opens up another field in the discussion of candle-power, wherein the carbon point plays an important part. In the commercial operation of alternating current arcs cored carbons are almost exclusively used. The constituency of the core has much to do with the efficiency of this type.

The comparison of the candle-power of a commercial alternating current arc with that of a direct current are consuming the same energy, as measured at the carbon points, shows that the former gives less illumination than the latter. So important is the relation of the carbon point to efficiency of the alternating current arc that the substitution of a solid carbon for a cored carbon in this form may reduce the candle-power and decrease the efficiency to such an extent as to make the lamp unmarketable.

Thus far we have discussed arcs which burn with free access of oxygen. In the case of inclosed arcs, or those which are operated in small bulbs, to which the air has very limited access, the conditions that govern the relation of watts to candle-power for the open air arc are more or less modified. With inclosed arcs purity of the carbon is very important, and in some applications of these arcs the objections which stand in the way of commercial utilization of pure carbon electrodes in open air arcs, do not apply.

DISCUSSION.

E. F. Peck: I do not know whether this Association desires to put itself on record as giving standards for various sizes of carbons or not; but it seems to me the arrangement for a two-thousand candle-power light, as given to us at Washington, really means nothing, as we find by experiment that we can get varying candle-power, using that amount of energy, by using different density of carbons and different size carbons. I would like to get information from some one here who has made experiments giving the candle-power by different size carbons, as to what the relative difference is in candle-power as governed by the size of the carbon.

L. B. Marks: In reply to Mr. Peck's question, I may say that the reference in the paper to current density partly answers his inquiry. It was stated there that within certain limits the candle-power varies inversely as the diameter of the carbon; that is in the assumption, of course, that current be constant and the carbons be of the same batch and homogeneous.

You will remember that Mr. H. Nakano, now professor of electrical engineering in the University of Japan, deduced a law for the relation of efficiency of the carbon to diameter. His results confirmed the conclusion reached by Schreihage, and indicate that the radiant efficiency is almost inversely in proportion to the diameter.

Thus we see that as far as the operation of arc lamps at maximum efficiency is concerned, the limitations of life of the carbon would cut a very important figure with the central station man. It is well to remember that invariably a gain in light efficiency for a given grade of carbon is accompanied by a loss of longevity of the carbon points. You all know that ordinarily a soft carbon will give you a better light than a hard one of the same diameter. If you use a hard carbon of small diameter you may obtain the same efficiency as with a soft carbon of larger diameter. Again, much depends upon the character of the basic material and the binder used in the manufacture of the pencil.

Again, though carbons of a certain diameter may be suitable for one purpose of illumination, change in the character of distribution of light desired may prove them to be less suitable for another. Even if the same current be used and the same watts expended in the lamp, it would be impossible to designate a particular size of carbon to meet all cases of distribution.

But, after all, why lay so much stress upon the diameter of the carbon or the candle-power of the arc? Does it make any difference to us whether an arc lamp gives five hundred or one thousand candle-power if the light is not available? As tersely stated by Professor Houston the other day, what we want is a method of measuring illumination at the surface which is lighted, and not at the source of illumination.

REPORT OF THE COMMITTEE ON STANDARD WIRING RULES.

This committee of the National Electric Light Association read its report at the recent Cleveland Convention. The committee is of the opinion that but slight changes in the existing rules could be desired. Joint meetings will soon be held with committees of the underwriters, street railway associations, telephone and other interests, and the committee promises a very satisfactory report to be made at the next convention. The committee consists of W. J. Hammer, chairman; James I. Ayer and H. M. Smith.

New Telephone Building.—The Rocky Mountain Bell Telephone Co., on February 14 opened its new building on State street, Salt Lake City, Utah. The building is used exclusively for the company's service. It is three stories high, and of neat and substantial architecture.

Mr. F. R. Upton, electrician, of Orange, N. J., made an assignment on March 2. W. J. Hammer and J. F. Randolph are the assignees.

PRINCIPLES OF DYNAMO DESIGN.

BY

Newton Harrison E.E.

(*Continued from Page 115.*)

The transformation of energy into heat in iron in the cases we are considering would occur were the subdivision or lamination carried to any point, because the losses experienced are not due to eddy currents of any description but to a species of internal magnetic friction. Foucault investigated the effect of iron masses revolving in a magnetic field and discovered losses in the iron that could not be accounted for but by the laws of electromagnetic induction.

Reference has already been made to the fact that the current circulating through the coils of a magnet would not be necessary after the first instant due to the retentivity of the iron, were it not for the fact that the mechanical shocks constantly occurring in the vicinity of the dynamo are conveyed to it through various mediums, and thus necessitate the continued presence of an effective magnetomotive force.

The observations made regarding the temperature increase in the iron indicates that no very great increase of heat in laminated iron could be expected from hysteresis alone, but that other causes, to be spoken of later, give rise to thermal effects. The most distinguishable of all would be the direct consumption of energy due to the reversals in the iron. These values, if properly given in practical units, will be of assistance in designing. S. P. Thompson gives a table "showing the number of watts wasted by hysteresis in well laminated soft wrought iron when subjected to a succession of rapid cycles of magnetization."

WASTE OF POWER BY HYSTERESIS.

B per sq. cm.	B'' per sq. inch.	Watts wasted per cubic foot at 10 cycles per second.	Watts wasted per cubic foot at 100 cycles per second.
4,000	25.800	40	400
5,000	32,250	47.5	575
6,000	38,700	75	750
7,000	45,150	92.5	925
8,000	51,600	111	1,110
10,000	64,500	156	1,560
12,000	77,400	206	2,060
14,000	90,300	202	2,620
16,000	103,200	324	3.240
17,000	109,650	394	3,940
18,000	116,100	487	4,870

The application of this table will be more evident when the subject of armatures is treated and the elimination of hysteresis is to be considered.

The more rapid the reversals of the magnetizing force the greater is the consumption of energy in the iron itself. The harder the iron or steel subjected to the test the more visible becomes the effects of the hysteretic action; very great amounts of power can be consumed by steel of good quality. Hopkinson examined a brand of oil-hardened tungsten steel and found out that it wasted as many as 216,864 ergs per cubic centimeter per cycle. This is about equal to .34 of a watt per cubic inch and would amount to an enormous quantity of energy per cubic foot at the standard frequency of the alternating current.

Steinmetz has given a more complete formula for the total amount of energy consumed by a block of iron exposed to cycles of magnetization. The loss of energy in the iron would be expressed by the equation

$$H = \eta B^{1.6} + \varepsilon N B^2$$

where $\eta B^{1.6}$ is the true hysteretic loss per cubic centimeter and the value $\varepsilon N B^2$ is the loss of energy by eddy currents per cycle and is proportional to the frequency N. The coefficients η and ε were calculated from a series of tests and found to be approximately:

$$\eta = .00333$$
$$\varepsilon = .746 \times 10^{-6}$$

Therefore the above formula in its complete form would be if B = the magnetization in lines of force per sq. cm.

$$H = .00333\, B^{1.6} + .746 \times 10^{-6}\, N B^2$$

As an illustration of its applicability we will give the losses in iron for different frequencies

1. True hysteretic loss $H = .00333\, B^{1.6}$
2. Iron loss for $N = 78$ = " " $+ .0000\,5856\, B^2$
3. Iron loss for $N = 140$ = " " $+ .000\,1022\, B^2$
4. Iron loss for $N = 209$ = " " $+ .000\,1567\, B^2$

Take for instance the fourth calculation; it would be carried on as follows:

$$.746 \times 10^{-6} + 209 = \frac{.746 \times 209}{1000000} = \frac{155.914}{10^6}$$

It is very evident that a fairly exact result is obtained by the above method though of a somewhat empirical character. The two coefficients η and ε have a variety of values dependent upon the quality of the iron or steel tested.

A collection of tests made by Steinmetz and giving the values of the coefficient η are worthy of consideration, because of the familiarity it will give the reader with the proper value of this quantity.

Material.	*Hysteretic Coefficient.*
Very soft iron wire........	η = .0020
Westinghouse converter..............	= .0024
Very thin sheet iron standard.	= .0030*
Thick sheet iron......................	.00333†
Sheet iron............................	.00421‡
" "...........................	.00450§
Soft annealed cast steel..............	.0080
Soft machine steel....................	.0094
Cast steel of low magnetic conductivity	.0120
Cast iron.............................	.0162
Hardened cast steel	.0250
Magnetic iron ore.....................	.02045

* For N = 100
† $\varepsilon = .746 \times 10^{-6}$
‡ $\varepsilon = .2083 \times 10^{-6}$
§ $\varepsilon = 1.16 \times 10^{-6}$

(*To be continued.*)

The Mexico Electric Co., Mexico, N. Y., has secured the contract for five years, beginning March 1st, to light that place by electricity. The price is $50 each for 25 arc lamps, and six 50 c. p. incandescent lamps, at $12.50 per lamp per year. Mr. E. L. Huntington is general manager of the company.

LEGAL.—It is reported that the General Electric Co. has attached the Leicester Electric Co., Leicester, Mass., on a $5,000 claim. The plant, it is said, will be sold by foreclosure proceedings on March 15.

NEW ELECTRIC LIGHT STATION.—The Cleveland Electric Light Company expects to soonstart its new station. The station will be equipped with "Climax" boilers, McIntosh and Seymour Engines and General Electric direct-connected generators. It will be one of the most complete plants in the country.

AN ENTERPRISING COMPANY.—We have received from Clyde C. Radabaugh, superintendent of the Electric Light and Power Co., Charleston, Mo., a copy of a handsomely gotten up card giving the company's prices of commercial and domestic lighting. The card tells a story of enterprise.

Infringement Suit.—The Detroit Motor Co., of Detroit, Mich., informs us that suit has been commenced by that company in the United States District Court, Indianapolis, Ind.. against the Jenney Electric Co., Indianapolis, for the infringement of the automatic release, which is owned by the Detroit Motor Co., and covered by patents. It is the purpose of the Detroit Motor Co. to prosecute any and all infringers of these patents.

New Corporations.

An electric light company has been organized in Iowa Falls, Iowa, with a capital stock of $15,000. The officers of the company are L. B. Bradley, president; J. I. McKay, secretary, and treasurer, and H. C. Miller.

The McLean Armature Co., Chicago, Ill., by James McLean, John S. Parmele and Martin R. B. Nelson. Capital stock, $15,000. Address John S. Parmele, room 415, 179 South Canal street.

Grand Rapids Electric Co., Grand Rapids, Mich., by Fred. M. Champlin, L. P. Cody, D. D. Cody, C. W. Carman and Daniel McCoy. Capital stock, $25,000.

The Schenectady Railway Co., Schenectady, N. Y., by P. F. Kobbe, Wm. H. White, A. G. McAndrew, of Schenectady. Capital stock, $300,000.

The Little Falls and Herkimer Street Railway Co., Little Falls, N. Y., by Clinton Deckwith, John F. Henderson, H. P. Witherstine, Robert Earl, of Herkimer; J. V. Quackenbush of Mohawk, and others. Capital stock, $10,000.

The Citizens' Telephone Co., Washington C. H., Ohio, by W. H. Dial, John N. Van Deman, and others. Capital stock, $10,000.

Fuller Electric Engineering Co., East St. Louis, Mo., by W. A. Fuller, Chas. T. Dana and G. H. Dudley. Capital stock, $30,000.

The Los Angeles Traction Co., Jacksonville, Ill., by Thos. J. Hook and Francis Hook, to operate street railways in California. Capital stock, $100,000.

Garrett Electric Light Co., Garrett, Ind. Capital stock, $20,000.

Bloomington Gas, Electric and Steam Heating Co., Bloomington, Ill., by Saml. P. White, R.T. McDonald, Jacob P. Smith, John J. Patterson, Geo. McIntosh, John Eddy and A. E. Demange. Capital stock, $50,000.

The Kramer Electric Mfg. Co., Chicago, Ill., by Edward Kirch, Frank A. Kramer and Max C. Krueger. Capital stock, $100,000.

The Western Hampshire Street Railway Co., Boston, Mass., by Lyman D. James of Williamsburg; Alvan Barrus of Goshen; J. C. Hammond of Northampton; John Olmstead of Springfield, and others. Capital stock, $200,000.

The Vicksburg Electric Light Co , by Jos. Hirsch, Chas. F. Armstrong, and others. Capital stock, $125,000.

The Virginia Telephone Co., Norfolk, Va., by D. Lowenberg, R. W. Arnold and Chas. Pickett. Capital stock, $5,000.

The Empire China Co., Greenpoint, N. Y., by Jas. L. Jensen, Jacob Ritschy, Thos. Morris, C. W. Chesshire and Robert Payn. Capital stock, $100,000.

The Waterport Electric Light and Power Co., Waterport, N. Y., by Lina Beecher of Batavia; C. A. Seaver of Batavia, and others. Capital stock, $40,000.

The Siloam Springs Improvement Co., Siloam Springs, Ark., by E. T. Wisner, R. S. Morris, Z. T. Conley, R. G. Alfrey, F. M. Axtell and E. B. Watson. Capital stock, $100,000.

The Cuero Telephone Co., Cuero, Tex., by C. L. Stadtler, S. C. Lackey, W. R. Rathbone, William Forbese, William Wagner, Lee Joseph and D. Hunter. Capital stock, $4,000.

The West Charleston Street Railway Co., Charleston, W. Va., by G. S. Laidley, G. S. Couch and J. W. Raike.

The Home Telephone Co., Chillicothe, O., by A H. Rentinger, David Auch and others. Capital stock, $25,000.

Phœnix Telephone & Mfg. Co., Chicago, Ill., by Lee R. Brown, E. E. Yaxler and others. Capital stock, $100,000.

A telephone company has been organized in Eaton, O., by L. D. Lesh and Frank Thompson. Capital stock, $5,000.

The International Telegraph & Telephone Co., Colville, Wash., by W. B. Aris, J. H. Young, F. W. Sherman, J. B. Stain. Capital stock, $25,000.

The Southwestern Illinois Telephone Co., East St. Louis, Mo., by Anthony Isch, Daniel Sullivan and A. Rodenberg Capital stock, $100,000.

Nantasket Electric Street Railway Co., Hull, Mass., by B. T. Harrington, treasurer, G. F. McKay and J. L. Mitchell. Capital stock, $12,500.

Suburban Gas & Electric Co., Revere, Mass., by Arthur Perry, president, William H. Whitney, treasurer, and Silston Burr. Capital stock, $75,000.

The Magnolia Avenue Railway Co., Jefferson City, Mo., by Thos. J. Prosser, W. W. Penny and others. Capital stock, $50,000.

The Onondaga Dynamo Co., Onondaga, N. Y., by Ella H. Eager, Jas. W. Eager and David Cronin of Syracuse. Capital stock, $25,000.

The Northwestern Telephone & Construction Co., Osage. Iowa, by H. J. Fitzgerald, C. H. McNider and H. C. Baldwin. Capital stock, $50,000.

The Pacific Storage Battery Co., San Francisco, Cal., by T. Addison, R. B. Elder, F. F. Barbour, F. M. Ray and S. E. Kearney. Capital stock, $20,000.

The New Home Telephone Co., Chillicothe, O., by Jas. M. Thomas, F. Harper, John H. Blacker and A. H. Rentmyer. Capital stock, $25,000.

Possible Contracts.

The plant of the Florence Electric Light and Power Co., Florence, S. C., was recently destroyed by fire. The loss was over $60,000.

New buildings, which will likely require electrical plants, are to be erected in the following named places by the parties named—Austin, Texas, sanitarium, by Dr. F. S. White; Benton, Tenn, court-house, address the county clerk; Elkins, W. Va., school, address Henry G. Davis; Fort Worth, Texas, business building, address Winfield Scott; South-Western Telephone and Telegraph Co., Galveston, Texas, new building; college dormitory, Georgetown College, Georgetown, Ky.; sanitarium, Little Rock, Ark., address John T. King; Masonic orphan asylum, Macon, Ga., address W. A. Davis; Masonic temple, Savannah, Ga., address R. N. Rutledge; office building, Towson, Md., by A. A. Piper; railroad depot, Trinity, Texas, by the International and Great Northern Railroad Company.

Chas. Goldsborough, Baltimore, Md., president of the Sinepuxent Beach Co., can give particulars regarding the proposition to build an electric road along the beach at Ocean City, Md.

The city council of Algiers, La, is about to sell an electric railway franchise.

Messrs. Crump & Holliday, Park City, Ky., can give particulars regarding the proposed electric railroad in that place.

A company is being organized in Richmond, Va., to construct an electric railway along Broad street. Julien Bryant can give further information.

Mr. Homer McLoughlin, East Liverpool, Ohio, has purchased the Wellsville electric light plant and will make material changes and additions thereto.

The Southern Equipment Co., Aberdeen, Miss., has leased the city electric light plant and will operate the same.

The city clerk of Albany, N. Y., can give information regarding the municipal electric light plant project.

The Llano Water-Works and Mill Co., Llano, Texas, is in the market for a 3,000-light incandescent dynamo, one mile of wiring and fixtures for 100 lights.

D. H. Ledbetter, Cordele, Ga., is in the market for a telephone line equipment, as is also the Clarksville Telephone Co , Clarksville, Tenn.

An electric light plant is to be established in Proctorsville, Vt., and bids will soon be asked therefor.

A flour mill is to be erected by M. E. Lesem, Rector, Ark., which will be lighted by electricity.

The Georges Creek Coal Co., Baltimore, Md., will instal a dynamo plant for use in its mines.

R. P. Williams and others of Newberne, N. C., will incorporate an electric light and power company in that place.

The Newport Mill Co , Newport, Tenn., will put in an electric light plant.

The Staunton Mutual Telephone Co., Staunton, Va., will establish a telephone system in that place.

Jas. S. Simons & Co., Roanoke, Va., can give particulars regarding the organization of a telephone company.

The City Council of Richmond, Va., has appropriated $150,000 for the erection of an electric light plant. The Mayor can give further information.

R. D. Gilliam, Petersburg, Va., may be addressed for further information regarding the proposed organization of a telephone company in that place.

The Buffalo & Williamsville Electric Railroad, Buffalo, N. Y., will extend its lines to Clarence, if satisfactory arrangements can be made.

A franchise has been granted to the Passaic and Newark Electric Railroad Co. by the Franklin Township Committee, Nutley, N. J.

William A. Russell, Lawrence, Mass., and the Manchester Electric Light Co., of Manchester, N. H., propose to erect a power plant at Garvin's Falls, near Concord, N. H.

The insane asylum, Lansing, Mich., will probably be lighted by electricity, an appropriation having been asked of the legislature to cover the cost of the same.

The Wichita Falls Construction Co., Wichita Falls, Tex., is in the market for the necessary material to build 18 miles of telegraph line with two wires.

The Alabama Legislature has authorized the City of Eufaula to build or buy an electric light plant.

Mr. S. Forbus, of Cincinnati, Ohio, is interested in a proposed new telephone system in Louisville, Ky.

It is stated that the Chattanooga Electric Railway Company, Chattanooga, Tenn., will extend its lines to Chickamauga Park, a distance of nine miles.

T. E. Welles, president of the Citizens' Telephone Company, Corsicana, Tex., wants lowest cash delivery prices on 150 battery telephones.

Telephone equipment is wanted by the Virginia Telephone Company, Norfolk, Va

Talbot & Van Horn, Springfield, Ohio, have obtained a franchise to establish a telephone exchange in that city.

A telephone company is to be established in Troy, Ala., by A. J. Robinson, of Atlanta, Ga.

J. W. Dodds and G. G. Leake, of Cedartown, Ga., are interested in a new telephone company to be established in Cartersville, Ga.

E. T. Hall, Cleveland, Tenn., can give information regarding a new electric light and water system in that city.

A. D. Reynolds, S. D. Jones and A. B. Marston, of Bristol, Tenn., are organizing a new telephone company.

The Piedmont Construction and Improvement Company, Charlotteville, Va., contemplates the extension of its electric road.

The Citizens' Street Railway Company, Pine Bluff, Ark., it is reported, will change its motive power to electricity.

The electric plant at Winchester, Ind., was recently destroyed by fire. Loss $10,000.

It is proposed to establish an electric light plant in Towanda, Pa. The mayor of that place can give further information.

It is probable that a municipal electric light plant will be established in Stanton, Mich.

The Atlantic City Street Railway Co., Atlantic City, N. J., endeavored to obtain permission to construct and operate a trolley line on certain avenues of that city. Permission, however, has been refused.

A fire alarm system is to be introduced in Sing Sing, N. Y.

The silk mill of Doherty & Wadsworth, Paterson, N. J., was destroyed by fire a few days ago, entailing a loss of $300,000.

Henry Fulmer of Easton, Pa., is interested in a project to build an electric road from Stroudsburg to Bangor and other places to Lake Poponoming.

The Long Island City & Newtown Railroad Co. and the Steinway Railroad Co. of Long Island City, N. Y., are talking about extending their lines.

It is proposed to establish an electric light plant in Roseville, O., by the local authorities.

Robert Goelet, 9 West 17th street, New York, proposes to erect a large hotel in Philadelphia.

A vote on the electric light question in Wallingford, Conn., resulted in favor of the project.

A vote in Waverly, O., on the question of electric lights in that place resulted favorably to the proposition.

The Alton Telephone Co., Alton, Ill., has asked permission to do business in that place. This company is an opposition to the Bell Co.

The Goodyear Vulcanite Co., of New York, will extend their works in Trenton, N. J., as soon as the weather will permit.

It is reported that the Narragansett Pier Railroad, Narragansett Pier Railroad, R. I., will change the motive power of its line from steam to electricity.

A telephone line is to be constructed between Fargo, Hillsboro and Grand Forks, N. D., by the Northwestern Telephone Co., Fargo, N. D.

The lines of the Burlington Electric Street Railway, Burlington, Ia., are to be extended to West Burlington, and other changes will be made in the system.

The car and power-house of the Lincoln Avenue cable line, Chicago, Ill., was destroyed by fire a few days ago. The loss was $300,000.

A company in Bucyrus, Ohio, has been granted a franchise to build an electric line from that city to Galion, a distance of twelve miles.

The Newton and Boston Street Railway Co., Newtonville, Mass., suffered the loss by fire of its car-house. eleven cars and a large quantity of electrical equipment. The loss is about $30,000.

The Mayor of Marion, Va., can give information regarding the proposition to light that place by electricity.

It is proposed in Union Springs, Ala., to issue $30,000 in bonds for the establishment of an electric light plant and water-works in that place.

Sealed proposals will be received by the city clerk of Meridian, Miss., until March 21, for the lighting of the streets of that place until June 1, 1900.

An electric light plant is to be established at the Penitentiary, Columbus, Ohio. The managers of that institution have the matter in charge.

Financial.

The annual report of the Brush Electric Light Co., of Rochester, N. Y., shows the assets to be $600,000 and liabilities $300,000. The capital stock of the company is $250,000.

The Rochester Gas & Electric Co has filed its annual report, which shows assets $5,500,000 and indebtedness $2,100,000.

"COMPOSITE MATERIAL" FOR ELECTRICAL SUBWAYS.

Messrs. Carter & Kinman, 228 West Second street, Los Angeles, Cal., have patented a "composite material" for pipes that is said to be a perfect non-conductor of electricity, and an excellent material for underground conduits. It can be moulded in any form and is strong and cheap. It is not affected in the least by gases, acids or alkalies, and is easily manufactured. Mr. George P. Low, the electrical engineer, of San Francisco, has submitted the material to severe electrical tests to determine its value for use as underground subways or conduits for electric wires. Excellent results were shown by the tests, and Mr. Low, in concluding his report, says "Composite Material, when properly made, possesses extraordinary advantages for use as subway conduits."

New York Notes.

OFFICE OF THE ELECTRICAL AGE,
WORLD BUILDING, NEW YORK,
MARCH 4, 1895.

The Metropolitan Traction Company has filed plans for alterations in its power-house, corner Broadway and Houston street, said alterations to cost $50,000.

The Electric Construction and Supply Company, 18 Cortlandt street, has assigned. This company was well known in the trade as the manufacturer of a very efficient arc lamp for incandescent circuits.

The electrical workers employed by the various electrical contractors in this city struck last Monday over alleged violations of agreement by the Electrical Contractors' Association. The Electrical Contractors' Association is determined not to yield, and as efforts to compromise the differences have failed, there is every indication that the fight will be a persistent one on both sides.

On the night of February 22 the employés of Zimdars & Hunt, 127 Fifth avenue, held their annual ball at Lyric Hall, on Sixth avenue. The feature of the occasion was the electrical decorations at the back of the hall. The letters "Z.-H.," and the formula, $C = E \div R$, formed of incandescent lamps, surmounted the stage, and there was an abundance of bunting, shields, etc., combined with lamps. The effect was exceedingly pretty and attractive. Three Lundell motors kept the flags fluttering, to give animation to the scene. Altogether about 250 lamps were used in the decorations. All the work was done by the employés themselves, each one doing his share. An enjoyable time was had by all.

Mr. Hunt, of the firm, accompanied by his wife and family, were present. At the supper table cheers were given for the firm and Mr. Hunt addressed the assemblage, praising the employés for the success of their first annual ball and the select manner in which it was conducted. The decorations of the ball-room were designed by Mr. J. P. Smith, and executed by the employés of Zimdars & Hunt, and carried out under the superintendence of Mr. J. F. Vielberth, assisted by Mr. Geo. Ruckle, Mr. J. I. C. King, Mr. Geo. McGibney, foreman, and other employés. Mr. Geo. T. Butler was president.

Mr. Wm. B. Van Size, the well-known patent attorney and expert, has moved his office to 253 Broadway. Mr. Van Size will act independently in the general patent soliciting and patent litigation business. W. T. H.

"ELECTRA" CARBONS.

The reputation of the Nuernberg electric light carbons for which Mr. Hugo Reisinger, of 38 Beaver street, New York, is the agent, is an excellent one. These carbons are known in the trade by the name of "Electra," and they are said to be superior to any others. They have been thoroughly tested by leading electric light stations in this country and uniform satisfaction is given by their use. They are so made that they produce no sparks during combustion. Their combustion is even and they give a brilliant and steady light. The "Electra" carbons are celebrated for their excellence of finish and fine composition, and in proportion to the current consumed produce the highest attainable candle-power.

The "Electra" carbons received the highest awards at the World's Columbian Exposition in Chicago, 1893, and they maintain their reputation always.

Trade Notes.

The Jewell Belting Co , of Hartford, Conn., during the month ending January 14, received an order for a four-ply belt 118 feet long and 78 inches (6½ feet) wide, and five orders for 62-inch three-ply belts aggregating 475 feet in length.

The Fulton Foundry and Machine Works, 21-27 Furman street, Brooklyn, is one of the best equipped establishments in this section for producing castings of the finest grades. This concern's popularity brings it plenty of business. They do all kinds of machine work, and make from drawings, etc., fine machinery of all kinds, and electrical castings. They also make to order dies and tools for all classes of work. The company makes a specialty of machinery and presses of all kinds for electrical purposes.

The Elwell-Parker Electric Co., Cleveland, Ohio, has sold to the Cleveland City Railway Co. a 1,000-H. P. generator.

F. E. Bruce, agent for Stirling boilers, has sold 4,000-H. P. to the Detroit Street Railway Co. This company is controlled by H. A. Everett and others, of Cleveland.

The F. E. Belden Mica Mining Co., miners and dealers in mica, Boston, Mass., have established a branch establishment at 182 Franklin street, New York city, with Mr. Union Adams as agent. All of the Belden Company's products will be found at the New York agency.

The Electrical Engineering Co., Minneapolis, Minn., has

just issued its catalogue No. 3 of electrical supplies for electric lighting, street railways and house wiring. The catalogue is very artistically gotten up and profusely illustrated. The Electrical Engineering Co. is dealer in general electrical supplies.

WOVEN WIRE BRUSHES

The Belknap Motor Co., of Portland, Maine, are the patentees and manufacturers of the best woven wire commutator brush on the market.

Electrical and Street Railway Patents.

Issued February 26, 1895.

534,650. Electrically-Actuated Combination Lock. Samuel L. G. Knox, Camden, N. J. Filed Apr. 13, 1894.

534,662. Electric-Railway System. Herluf A. F. Petersen, Milwaukee, Wis. Filed Nov. 8, 1893.

534,663. Underground Conduit for Electric Railways. Herluf A. F. Petersen, Milwaukee, Wis. Filed Mar. 26, 1894.

534,670. Telegraph and Telephone System. Charles A. Rolfe, Chicago, Ill. Filed Sept. 16, 1893.

534,671. Fire-Alarm-Telegraph System. Charles A. Rolfe, Chicago, Ill. Filed Aug. 10, 1894.

534,677. Electric-Arc Lamp. Hans O. Swoboda, New York, N. Y., assignor to the General Incandescent Arc Light Company, same place. Filed Apr. 6, 1894.

534,678. Electric-Current Transformer. Joseph A. G. Trudeau, Ottawa, Canada. Filed Apr. 6, 1894.

534,699. Electric Resistance Card. Alton J. Shaw, Muskegon, Mich. Filed Dec. 1, 1894.

534,711. Compressed-Air Motor for Street-Car Propulsion. William Creely, Bay City, Mich. Filed Apr. 6, 1894.

534,731. Method of and Means for Preventing Magnetic Leakage. Elihu Thomson, Swampscott, assignor to the General Electric Company, Boston, Mass. Filed Feb. 6, 1893.

534,732. Connector for Electric Conductors. Robert D. Titcomb, Schenectady, N. Y., assignor to the Thomson-Houston Electric Company, Boston, Mass. Filed Dec. 21, 1894.

534,752. Brake for Railway-Cars. Thomas Millen, New York, N. Y. Filed Oct. 25, 1894.

534,785. Method of and Apparatus for Insulating Electrical Conductors. Louis W. Downes, Providence, R. I. Filed Aug. 22, 1894.

534,802. Electric Metal-Working Apparatus. Hermann Lemp, Lynn, Mass., assignor to the Thomson Electric Welding Company, of Maine. Filed Dec. 3, 1892.

534,815. Electric Slot for Signals. John P. Coleman, Swissvale, Pa., assignor to the Union Switch and Signal Company, same place. Filed Sept. 27, 1893.

534,822. Fender for Cars. Stephen Essex, Providence, R. I., assignor to himself and Isaac W. Sawin, same place. Filed July 7, 1894.

534,834. Battery System for Electric Railways. Edmond Julien, Brussels, Belgium, assignor to the Electric Storage Battery Company, Gloucester, N. J. Filed Dec. 9, 1886. Patented in England, Feb. 19, 1886, No. 2,470, and in Belgium Nov. 19, 1886, No. 75,288.

534,852. Electric-Arc Lamp. James Brockie, Forest Hill, England. Filed Nov. 13, 1894. Patented in Belgium Nov. 3, 1894, No 112,533; in Hungary Nov. 21, 1894, No. 1,635; in Italy Nov. 26, 1894, LXXIII, 417, and in Austria Dec. 4, 1894, No. 6,226.

534,886. Electrical Lighting Device for Gas Engines. Calvin L. Ives, Grand Rapids, Mich. Filed Mar. 30, 1894.

534,908. Electric Signaling Apparatus. Bernice J. Noyes, Boston, Mass., assignor to George W. Gregory, same place. Filed July 5, 1892.

534,913. Car Fender. Horatio Phinney, Providence, R. I. Filed Nov. 21, 1894.

534,942. Manufacture of Articles by Electro Deposit. Henry S. Anderson, Springfield, Mass. Filed Dec. 18, 1889.

534,953. Dynamo-Electric Machine. Rudolf Eickemeyer, Yonkers, N. Y. Filed June 7, 1888.

534,956. Electric Trolley Railway. Joshua M. Hammill, Aldan, assignor of one-fourth to John S. Latta and James J. Mulconroy, Philadelphia, Pa. Filed Jan. 23, 1894.

534,961. Electrically-Operated Keg Register. Josef Kuff, New York, N. Y., assignor, by mesne assignments, of one-half to Mary A. Richter, same place. Filed April 4, 1894.

534,970. Telegraph and Telephone System. Charles A. Rolfe, Chicago, Ill., assignor to the Police Telephone and Signal Company, same place. Filed Feb. 15, 1893.

534,971. Incandescent Light. Henry F. Rooney, Randolph, Mass. Filed Nov. 17, 1894.

534,974. Electric Brake. Elmer A. Sperry, Cleveland, Ohio, assigor to the Sperry Electric Railway Company, of Ohio. Filed Jan. 30, 1894.

534,975. Apparatus for Arresting Motion of Electrically-Propelled Mechanism. Elmer A. Sperry, Cleveland, Ohio: assignor to the Sperry Electric Railway Company, of Ohio. Filed Feb. 5, 1894.

534,977. Electric Brake. Elmer A. Sperry, Cleveland, Ohio, assignor to the Sperry Electric Railway Company, of Ohio. Filed June 8, 1894.

534,982. Car Fender. Albert J. Thornley, Pawtucket, assignor to the Consolidated Car Fender Company, Providence, R. I. Filed Dec. 6, 1894.

534,986. Conduit Electric Railway. Michael F. Flynn, Stamford, Conn. Filed May 24, 1894.

ELECTRICAL AGE

VOL. XV., No. 11. NEW YORK, MARCH 16, 1895. WHOLE No. 409

ESTABLISHED 1883.

Entered at New York P. O. as second-class matter, January 18, 1891.

THE ELECTRICAL AGE PUBLISHING CO., PUBLISHER

TERMS OF SUBSCRIPTION:

One Copy, one year,	$3.00
One Copy, six months,	1.50
Great Britain and other Countries,	4.00

Cable Address (all Cables,) "Electage," New York.

W. T. HUNT, President F. N. BASSETT, Vice-President.

T. R. TALTAVALL, Secretary and Editor.

NEWTON HARRISON, E. E., Scientific Editor.

ADDRESS ALL COMMUNICATIONS TO

THE ELECTRICAL AGE PUBLISHING COMPANY,

FIRST FLOOR, WORLD BUILDING.

NEW YORK.

NEW YORK, MARCH 16, 1895.

CONTENTS.

THE BROOKLYN TROLLEY ACCIDENTS.

Among the recommendations made by the State Board of Railroad Commissioners in its report of the investigation of trolley accidents in Brooklyn, was that the method of payment of the motormen and conductors shall be such as in no event to tend to cause employés to attempt to make up time by running at an excessive rate of speed. The board is of the opinion that the fenders now in use on the Brooklyn cars are of little or no practical use. The use of some improved form of air-brake is also recommended.

RAPID TRANSIT IN NEW YORK.

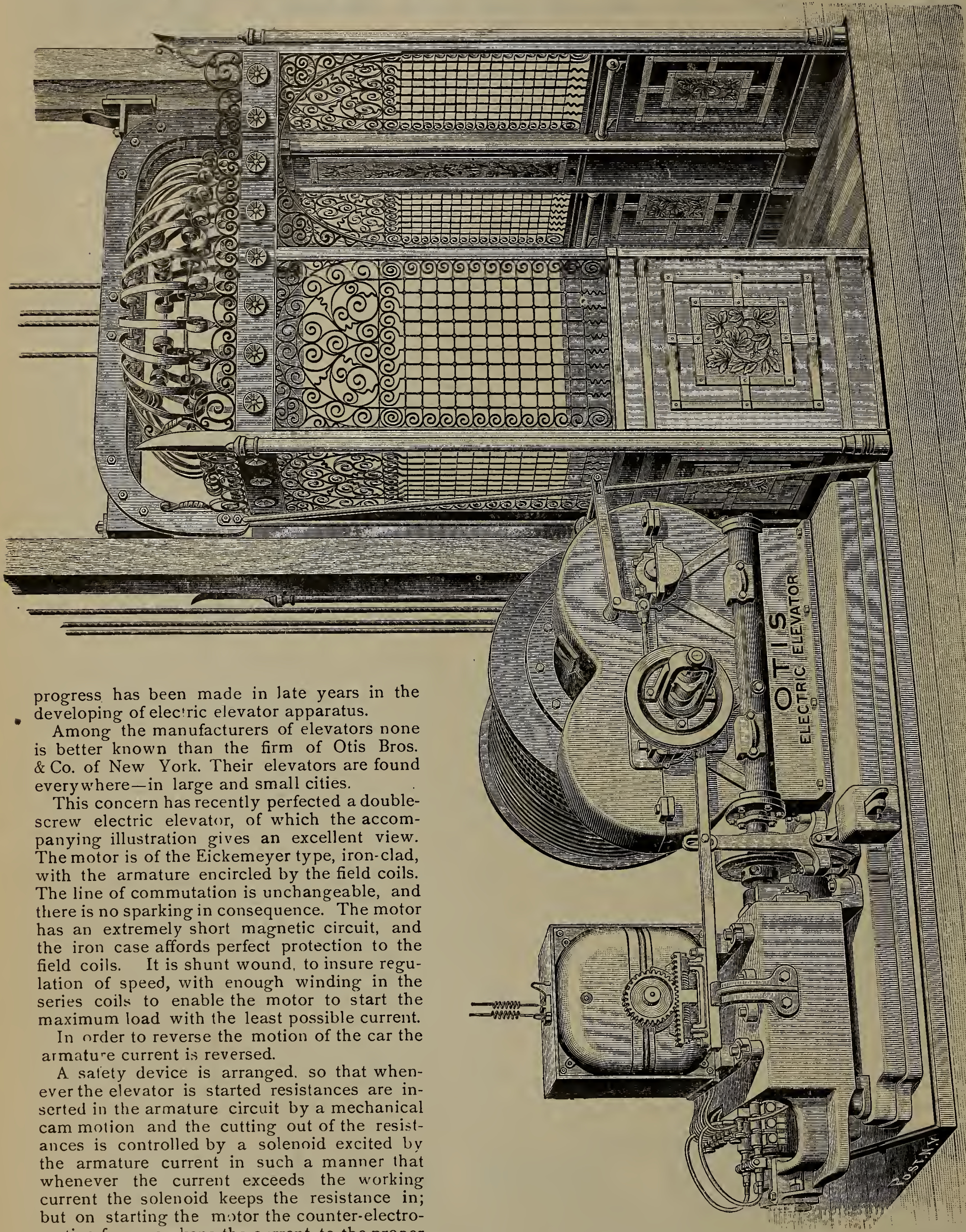
The Rapid Transit Commission has at last adopted a route for the proposed roads, and taken the first practical step towards a realization of the fond hopes of New Yorkers to see rapid transit—some day. It will require several years to get the underground roads into operation, and what the suffering public is going to do in the meanwhile is hard to predict. We think the commission should grant the elevated railroad company the privilege of extending its facilities as far as it can, so as to provide quicker and more ample service than it renders at present. The company is hampered by legal obstructions innumerable. There is no doubt that the present lines could be provided with additional trackage in order to give quicker transit, if such obstructions could be removed. Such an extension would help out during the interval in which the work on the underground roads is being carried on, and afterwards, we venture to say, the elevated roads would have all the business they could attend to comfortably. We think a majority of the people would prefer to ride in daylight on a high level rather than use a tunnel road.

ELECTRICAL DEVELOPMENTS ABROAD.

In the "Notes on Recent Electrical Engineering Developments in France and England," read by Mr. H. Ward Leonard before the American Institute of Electrical Engineers at the last meeting, there is much to inspire a feeling of pride in America's position in electrical engineering. Of course Mr. Leonard's report is based entirely upon his individual judgment, and must be regarded in this light, but his reputation is such as to warrant the belief that his statement of the facts and comparisons are as fair as any one individual could make them. In England, alternating current practice is in advance of ours. Mr. Leonard thinks this is due to the inertia and prejudice of large corporations in America, in continuing to install the two-wire 50-volt secondary. He finds that dynamos and motors are cheaper in the United States than in either England or France, notwithstanding the advantages these countries are supposed to have over us in the matter of cheaper raw materials and labor. Mr. Leonard speaks in commendation of the rotary transformer practice in England. In the matter of steam-engines he thinks we are ahead of either of the two countries named. For efficiency, design and amount of material used American engines are superior. The Parsons steam turbine produced a strong and favorable impression upon Mr. Leonard. He referred to the five-wire system as exemplified at Manchester; the Liverpool Electric Railway; English central stations; French central stations; electric heating and the Heilmann locomotive. Regarding the latter, Mr. Leonard stated it as his opinion that electrical engineers would in the immediate future be bound to give this machine the most respectful consideration. Altogether Mr. Leonard's paper was a most interesting one, and while that gentleman points out some American weaknesses, the losses are far more than offset by the gains.

OTIS DOUBLE-SCREW ELECTRIC ELEVATOR.

Electric power is rapidly crowding out steam and hydraulic power as a means of operating elevators, and much progress has been made in late years in the developing of electric elevator apparatus.



OTIS DOUBLE SCREW ELECTRIC ELEVATOR.

Among the manufacturers of elevators none is better known than the firm of Otis Bros. & Co. of New York. Their elevators are found everywhere—in large and small cities.

This concern has recently perfected a double-screw electric elevator, of which the accompanying illustration gives an excellent view. The motor is of the Eickemeyer type, iron-clad, with the armature encircled by the field coils. The line of commutation is unchangeable, and there is no sparking in consequence. The motor has an extremely short magnetic circuit, and the iron case affords perfect protection to the field coils. It is shunt wound, to insure regulation of speed, with enough winding in the series coils to enable the motor to start the maximum load with the least possible current.

In order to reverse the motion of the car the armature current is reversed.

A safety device is arranged, so that whenever the elevator is started resistances are inserted in the armature circuit by a mechanical cam motion and the cutting out of the resistances is controlled by a solenoid excited by the armature current in such a manner that whenever the current exceeds the working current the solenoid keeps the resistance in; but on starting the motor the counter-electromotive force weakens the current to the proper working degree, and the resistances are free to be cut out by the balance-weight. The balance-weight has a constant tendency to cut the resistances out as soon as the proper strength of the armature current passing through the solenoid allows it to act. This arrangement acts as a safety device, and prevents the annoyances incident to the blowing of the fuse.

The mechanical arrangements of the controlling gear of the elevator are designed with great care to prevent jars and heavy pressures.

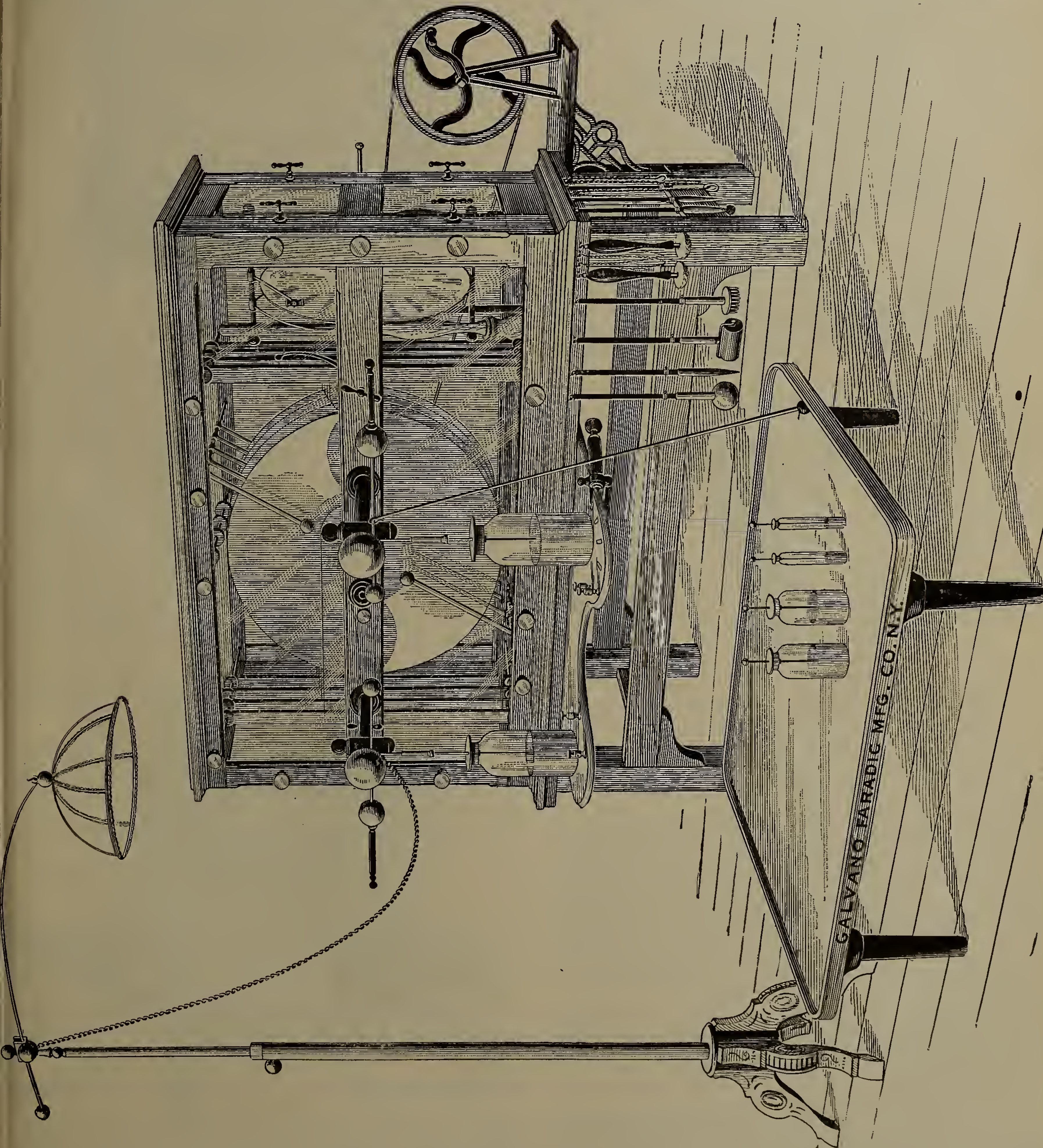
To lessen the surface pressures and wear on the gears, double worm wheels, with right and left screws are used. By this arrangement the load is positively divided between the two wheels and two worms, and loss of power at the end thrust is entirely eliminated. By a special system of

over-balancing the pressure is again halved by the half load. This admits of the use of a smaller motor, and greatly reduces the strains on the hoisting gear. The smaller motor, of course, takes less starting current.

The safety devices of this elevator are as complete and reliable as the best now used on hydraulic and steam elevators.

MORTON-WIMSHURST-HOLTZ INFLUENCE MACHINE.

This machine, of which an illustration is given, is designed for therapeutical use. It embodies every improvement in machines of this class and answers every purpose in medicine to which such apparatus can be applied. It is made in two sizes; one size having eight revolving 30-inch plates, and the other six revolving 28-inch plates, each with a corresponding number of stationary plates. The revolving plates are provided with ball bearings and are turned with great ease.



MORTON-WIMSHURST-HOLTZ INFLUENCE MACHINE.

The small machine shown at the right end of the case is of the Wimshurst type and is used as an exciter to charge the large plates, when the latter lose their charge, as they sometimes do in humid weather. Both machines are operated by the same driving wheel, and only a few minutes' operation is needed to charge the large machine. When this is accomplished, connection with the Wimshurst machine is broken.

The Leyden jars are supported on a shelf, on the underside of which is arranged a simple device for giving the spark, spray and Morton static induced and transformer currents. The spark varies in length from nine to twelve inches and is of great volume.

This machine represents the result of long-continued experiments with a view to produciug a perfect machine, and it has met with a well-merited recognition in the

medical profession. The Galvano-Faradic Manufacturing Co., of 300 Fourth avenue, New York city, are the manufacturers of these machines. This company has been making them a little over a year, and in that time over thirty of the most prominent physicians in New York, Boston, Philadelphia, Chicago and San Francisco have been supplied with them. A few days ago the company sent a 6-plate machine to Dr. G. Belton Massey of Philadelphia. This is the second machine Dr. Massey has ordered, his first one having been in use several months.

MINIATURE LAMPS.

The readiness with which the incandescent electric lamp lends itself to extraordinary uses is well known. No other form of light can, with the same ease and safety, be adapted to the same uses and the same situations.

For decorative and experimental purposes, and professional work, the little lamps made to be lighted by battery current are unequalled. The four candle-power lamp shown in Fig. 1 requires a current pressure of 7 to 9 volts, and a volume of 1 to 1.75 amperes to develop full candle-power.

The smallest standard electric lamp made is known as the pea lamp (Fig. 2). This diminutive light-giver is not so thirsty for current as the first lamp referred to. But it gives a light of only one half candle-power. To get this illumination from it requires a current of from .90 to 1. ampere at a pressure of from 3 to 4 volts.

An example of candelabra lamps is shown in Fig. 3. This lamp has its filament shaped like an arrow–head. It gives an illumination of one candle-power with .40 amperes

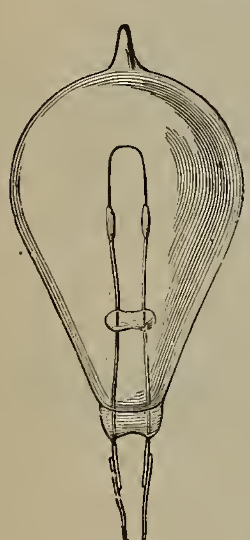


FIG. 1.

FIG. 2.

FIG. 3.

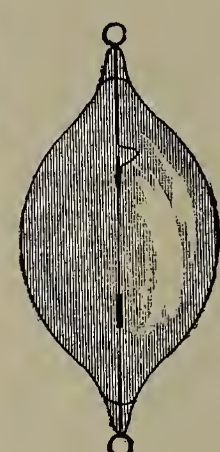


FIG. 4.

of current at 14 volts. Candelabra lamps are made in three different styles. They can be burned 2, 3, or 4 in a series in electric lighting currents of 100 to 120 volts, and 2 in series, or in multiple on circuits of from 50 to 60 volts.

Fig. 4 shows a special series lamp of one candle-power. The series lamps are designed for signs, decorative work, etc., and owing to their form no receptacles are necessary. They generate very little heat. These small units can be grouped and arranged with great facility, and are extremely convenient for decorative effects at fairs, banquets, balls, dinners, etc. The bulbs come in various colors for decorative purposes.

All the illustrations used herewith show the full size of each lamp represented.

These miniature lamps, which are made by J. Jones & Son, 67 Cortlandt street, New York, are of the very best construction and material, and they are made in various forms other than those above illustrated.

Tempering Aluminum.—It is stated that F. Allard, a blacksmith of Levis, Ont., has discovered a process of successful tempering aluminum which gives the metal the consistency of iron. Among the things hardened was a small cannon, which withstood the shock of a heavy charge of powder. The Canadian military authorities, it is stated, will look into the value of the discovery.

THE BELKNAP MOTOR CO.'S EXHIBIT.

Those who attended the Cleveland Convention of the National Electric Light Association last month will at once recognize in the accompanying illustration one of the most attractive exhibits there. It is one thing to exhibit goods and another to give life to the exhibit. The Belknap

BELKNAP MOTOR CO.'S CONVENTION EXHIBIT.

exhibit was endowed with the property of "change," therefore it was attractive.

The device illustrated consisted of a square black glass frame with a circle of white in the centre. At each corner of the frame, set out on the surface of the glass, was the end of a commutator, fitted with woven wire brushes held by movable holders. Woven wire brushes were also disposed around the edges of the frame, and in the centre of the circle was the end of a commutator, placed in a manner similar to the ones on the corners. Behind the frame colored incandescent lamps revolved around the central point, lighting up the words in the circular space with brilliant effect.

This exhibit was pronounced one of the most attractive made, and Mr. R. B. Smith, the representative of the Belknap Motor Company, of Portland, Me., was warmly congratulated for the beauty of his company's display.

THE MOREHOUSE TELEPHONE TRANSMITTER.

The accompanying illustrations give a front view and a cross-sectional view of the Morehouse telephone transmitter that has been working practically with the most satisfactory results.

It is a very simple device in construction, and entirely

Fig. 1.

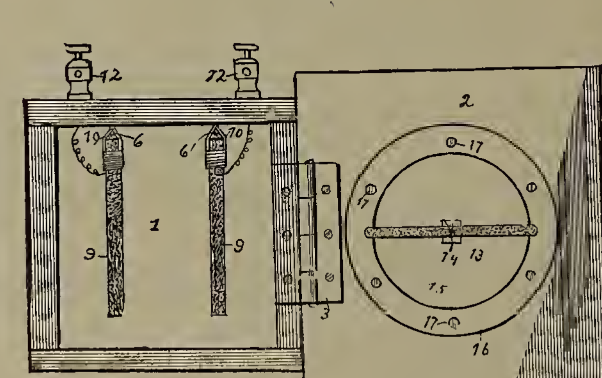
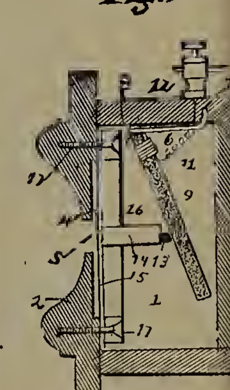


Fig. 2.



different from anything now in use. It has a free vibrating diaphragm outside the circuit, unobstructed by springs or pads, which communicates its vibrations through two or more unequally adjusted contacts to a microphone of extreme sensitiveness, It is capable of transmitting all sounds audible to the human ear with a clearness and

roundness of tone equal to that of the original voice. The faintest sound is easily heard in the receiver, and when standing three or four feet away from the instrument an ordinary low tone of voice will transmit perfectly.

The instrument is always in adjustment and is permanent in action. Its construction will be easily comprehended by reference to the illustrations.

To the inner centre of the diaphragm disk is cemented a stud of pine wood, the inner end of which is hollowed out to receive the cross-bar carbon, the carbon being cemented to the stud. Freely suspended from the top of the interior of the box are two light carbons (Fig. 1). On closing the door of the transmitter the suspended carbons are pressed backward and lay at an angle upon the bar. (Fig. 2). In this way the circuit is completed without passing through the diaphragm.

The vibrations of the diaphragm cause a frictional movement at the two points of contact, and the fact that these points cannot be adjusted in unison is the reason why this transmitter has a modifying, blending and softening effect.

These transmitters have been in constant use for a year on 35 miles of old telegraph wire, long since classed as "dead" on account of its poor and unsoldered joints, and generally decayed condition. Under these (ordinarily adverse) circumstances these instruments have given perfect results.

The inventor, Mr. M. A. Morehouse, an electrician, of Wevertown, N. Y., has conversed with ease with a person standing 20 feet from the transmitter in an adjoining room, the latter's position being at right angles with the instrument and not in front.

The instrument is a powerful transmitter and has a wide range of action, since it will transmit the faintest to the loudest noise.

DIAMOND ELECTRIC COMPANY'S WATTMETER AND TRANSFORMER.

At the Electric Light Convention in Cleveland last month much interest was manifested in the Scheefer Recording Wattmeter for alternating currents and the Diamond transformer exhibited by the Diamond Electric Company, of Chicago.

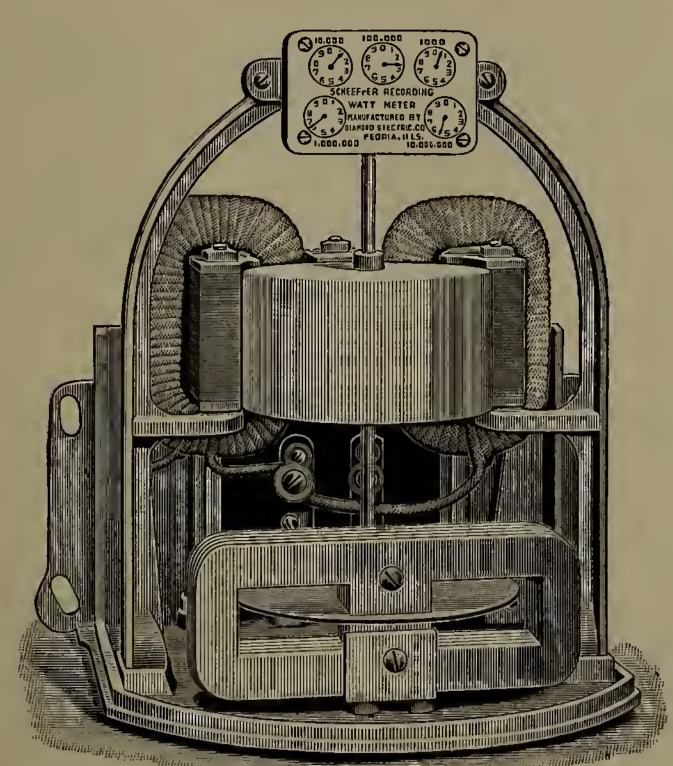


FIG. 1.

The Scheefer Wattmeter (fig. 1,) registers direct the actual power consumed, and is therefore fair in its record to both supplier and consumer. It is practically free from friction losses; there being no brushes, and only two vertical bearings. There is no dead weight in the shape of wire on the armature and no commutator to watch. This instrument is said to be absolutely reliable, and is accurate both on one lamp or on full load. The wattmeters are made for 50-volt and 100 to 110-volt circuits, and range from 10 to 300 lights. The instrument is well made, and reference to the illustration tells a story of simplicity in construction. The Diamond transformer is a very convenient, serviceable and efficient device. By reference to fig. 2, its construction will be readily understood. The front lid drops on hinges, allowing free access to the fuses, and when it is closed the contact surfaces are brought together, thus establishing the circuits. These transformers are very safe to handle and easily installed. The coils are subdivided and ventilated so as to keep them as cool as possible, and as they are carefully looked after during the process of construction, they entail little expense for repairs.

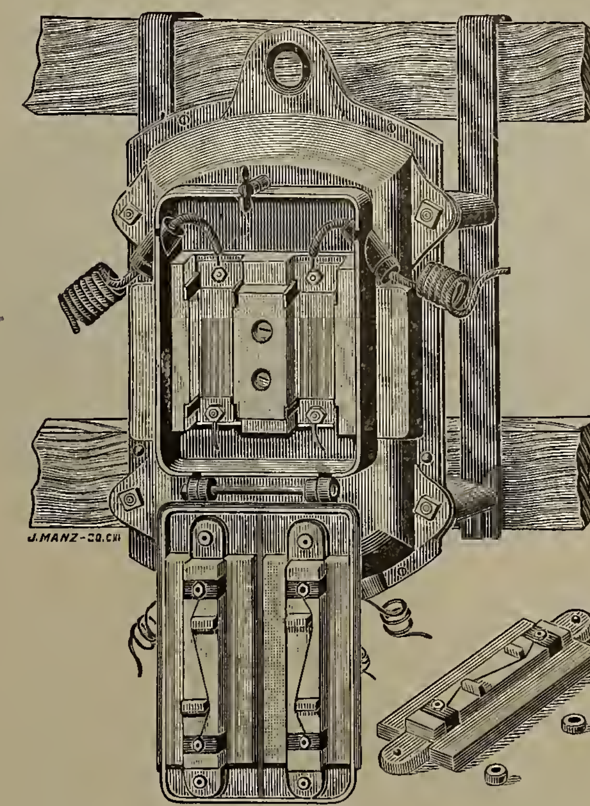


FIG. 2.

The Diamond transformer is suitable to all systems and is made for any voltage or capacity. It is of high efficiency, low leakage and of the best regulation.

Mr. A. M. Searles, manager of the sales department of the Diamond Electric Company, did effective work at the convention with these two instruments, in bringing them to the attention of the delegates. The company's factory is in Peoria, Ill.

THE INTERNATIONAL TELEGRAPH CONVENTION.

The International Telegraph Convention is a permanently organized body of government representatives which met originally at St. Petersburg, in 1875, to consider and agree upon rules and regulations for the interchange of telegraphic correspondence between states and for collecting and apportioning the charges thereon in proportion to the amount of work performed by each state, and to establish a central office called the International Telegraph Bureau, to collect, arrange and publish information of all kinds relating to international telegraphy.

Since then the convention has met in London, Berlin and Paris. The meeting at Paris in 1890, in view of the difficulty experienced in regulating the use of code or preconcerted language and the increasing tendency on the part of the public to use combinations of letters and to evade necessary restrictions, decided to instruct the International office, which had been established at Berne, Switzerland, to prepare and publish a vocabulary of authorized code words which should come into use three years after the date of publication and be the sole authority on the legitimacy of code words. The vocabulary has now been published. It contains 250,000 words of not more than ten letters. The convention recognizes two classes of telegraphic correspondence, that which passes between states within the

limits of Europe and is called European, and that which passes between Europe, Asia, America, Africa and Australia direct, or by way of Europe. which is called Extra-European. After the 1st of January, 1898, European telegrams containing code words which cannot be found in the vocabulary *will not be accepted for transmission.* The convention will hold its next meeting at Buda Pesth, in 1896, and it has already been decided to take up the question of extending the use of the official Vocabulary to Extra-European traffic and it is certain to be adopted.

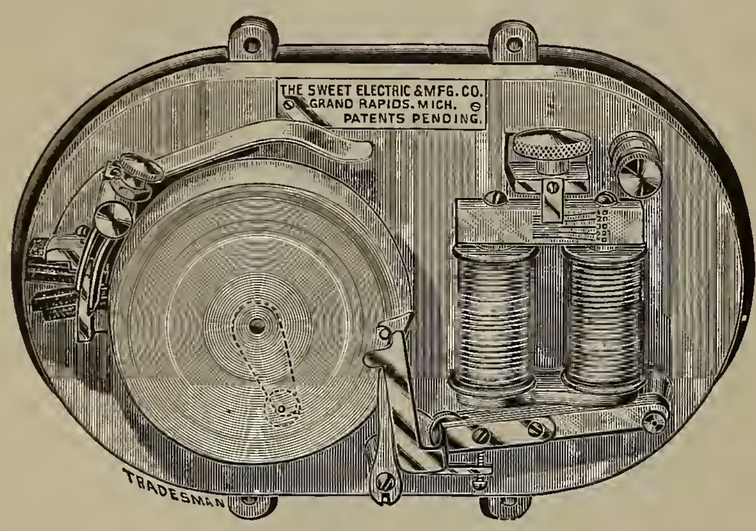


FIG. 1.

This will include all messages transmitted by the Atlantic cables.

Mr. Geo. G. Ward, vice-president and general manager of the Commercial Cable Company, expressed himself as confident of the Official Vocabulary being adopted as the standard for code words to be used in cablegrams If a word cannot be found in the Vocabulary it is not a code word. It will put an end to all disputes, he said, as to the legitimacy or illegitimacy of a code word.

The Signatories to the convention are Great Britain, Germany, Argentine Republic, South Australia, Austria-

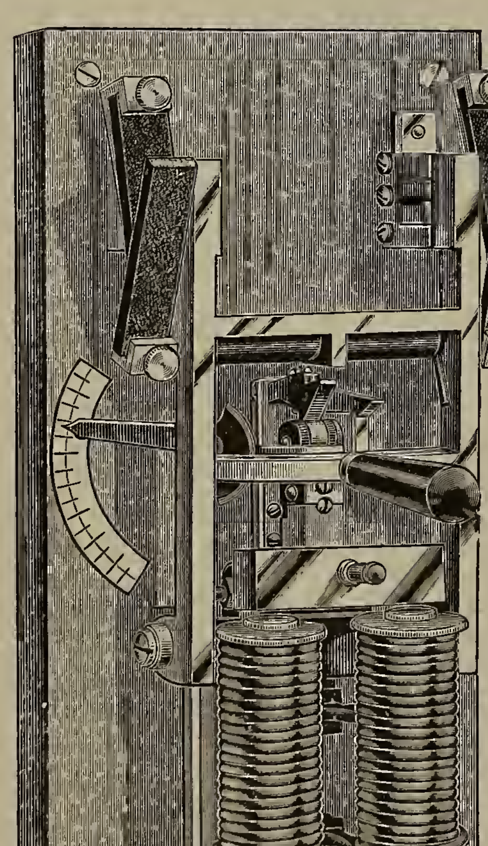


FIG. 2.

Hungary, Belgium, Brazil, Bulgaria, Cape of Good Hope, Cochin-China, the Spanish Colonies, Denmark, Egypt, Spain, France, Greece, the Dutch East Indies, Italy, British India, Japan, Luxemberg, Montenegro, Natal, Norway, New South Wales, New Zealand, Holland, Persia, Portugal, Roumania, Russia, Senegal, Servia, the Kingdom of Siam, Sweden, Switzerland, Tasmania, Tunisia, Turkey, Victoria.—*Telegraph Age.*

SWEET AUTOMATIC LIMIT SWITCH.

The apparatus made and exhibited by the Sweet Electric and Manufacturing Company, Grand Rapids, Mich., at the Cleveland Convention last month, deserves more than passing mention.

The non-arcing automatic magnetic limit switch, illustrated in Fig. 1, is designed for use on electric cars, to take the place of fuse-boxes, and to disconnect the motor from the circuit in case of accident, by simply pushing a button. This obviates the awkward necessity of pulling down the trolley arm, and at the same time the light in the interior of the car is maintained, thus avoiding the usual consequence of pulling the trolley arm down. As applied to double equipments, it cuts out the defective motor, leaving the good one in circuit for operation.

With this switch on cars, the station is not only protected, but every car is running independent of each other, and in case of grounds or short circuits, the excessive current is checked on the instant the predetermined current reaches the limit switch.

The switch occupies a space of 3x8x11 inches, and can be placed in any position inside or outside of the car. It is made in capacities of from 25 to 200 amperes, and is adjustable.

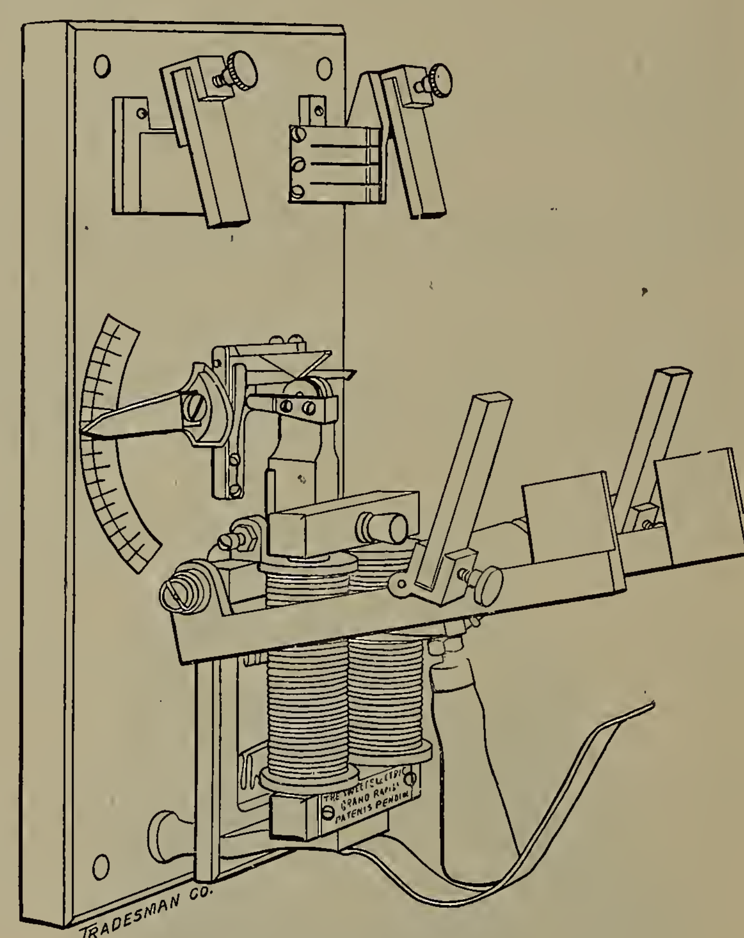


FIG. 3.

The station limit switch, which was also exhibited, protects dynamos, motors, lamp circuits and other electrical apparatus or combination against over-production of current or overload. Fig. 2 shows the switch closed, and in Fig. 3 the switch is shown open. It is claimed to be an absolutely reliable protection against short circuits, and when such occur it automatically opens the circuit, thus cutting off all danger. It is equally valuable for telegraph, telephone and fire-alarm systems, and does away with the necessity of using fuses for protection.

The switch is constructed on correct mechanical and electrical principles. The contact is broken between carbons.

In applying the switch the indicator is set to the number representing the amperes to be carried, and if the current exceeds the limit by from one-twentieth to one-fourth of an ampere (according to the size of the switch) the circuit is at once opened.

The instrument is mounted on a solid marble base, with back connections, and is very substantial and neat in appearance.

The Sweet company makes single and double-pole hand switches with its patent rotating carbon device, which avoids the drawing of an arc. The company makes a specialty of the manufacture of switchboards with marble bases, for any sized plant, furnishing all the necessary instruments.

PRINCIPLES OF DYNAMO DESIGN.

BY

Newton Harrison E.E.

(*Continued from Page 144.*)

If it be remembered throughout, as Steinmetz himself has stated, that

$\eta B^{1\cdot 6}$ = the loss of energy by hysteresis proper, or by *molecular friction* and $\varepsilon N B^2$ = the loss of energy by *eddy currents*, per magnetic cycle and per cubic centimeter, proportional to the frequency N; the clear understanding of the dual effects that appear as heat and consume energy will be comparatively easy.

In the case of an armature core revolving in a magnetic field, we cannot consider the armature as being under the influence of a true cycle of magnetization. The true condition of affairs in such a case is the subjection of the core to a positive and negative maximum of lines of force. The absorption of power due to this cause is but a small percentage of the total energy. If the number of revolutions per minute be taken into account and the maximum values of the induction be properly represented, the formula for the loss in any armature core will be

$$W = \eta N 10^{-7} \left(\frac{L_1 - L_2}{2}\right)^{\cdot 6}$$

where W = watts lost per cubic centimeter.

N = number of complete periods per second.

$L_1 - L_2$ = maximum values of magnetic induction in lines per sq. cm.

η = .00350 for sheet iron having the following thicknesses:

$$\left.\begin{array}{l} .042 \\ .026 \\ .038 \\ .071 \\ .071 \end{array}\right\} = \eta$$

If in such a case as the above the loss in an armature core revolving 1,000 times a minute with an induction of 16,000 lines per sq. cm. we have

$$(L_1 - L_2) \div 2 = 16000$$
$$N = 1000 \div 60 = 16.67$$

therefore $W = 0.0035 \times 10^{-7} + 16.67 + (16000)^{1\cdot 6} = 0\ 031$ watts per cubic centimeter. The above calculation is taken from the transactions of the American Institute of Electrical Engineers. Many other similar cases can be treated in the same manner

The diagram (Fig 24) representing the values of the losses occurring in the armature of a dynamo has been given for the purpose of showing the proportional wastes of energy due to friction, hysteresis, etc.

Although the hysteretic loss is not of a very great value in the general run of machines, it necessitates the choice of a fine quality of sheet iron for the armature core, that is to say, iron of but little coercive force. The lamination is adopted merely to reduce the Foucault effect—the generation of eddy currents in the core.

According to Steinmetz, the hysteretic loss in the armatures of all sizes of machines is but a *fraction of one per cent.* If for convenience the losses in a machine were divided up, we could classify them as mechanical, electric and magnetic losses.

It has been observed that there is an enormous increase of permeability in iron that is vibrated throughout by tapping while exposed to a low magneto-motive force. This is explained by the fact that without the mechanical disturbance of the particles, more energy would have to be consumed to overcome molecular friction than is supplied by the exciting current.

The vibration of a magnetic circuit by either the passage of an alternating current through it or by mechanical means does not save that circuit from the inevitable loss due to molecular friction, the loop of hysteresis is made to collapse, but that does not necessarily imply the absence of internal friction. The loss has in fact increased; instead of the single condition existing, an additional one has been introduced, namely, the mechanical *vibration* of the molecules, and these two in total now represent the entire loss.

The line to be drawn between the two is, that hysteresis may disappear by the above conditions, but not molecular friction; that is to say, the energy required for the removal

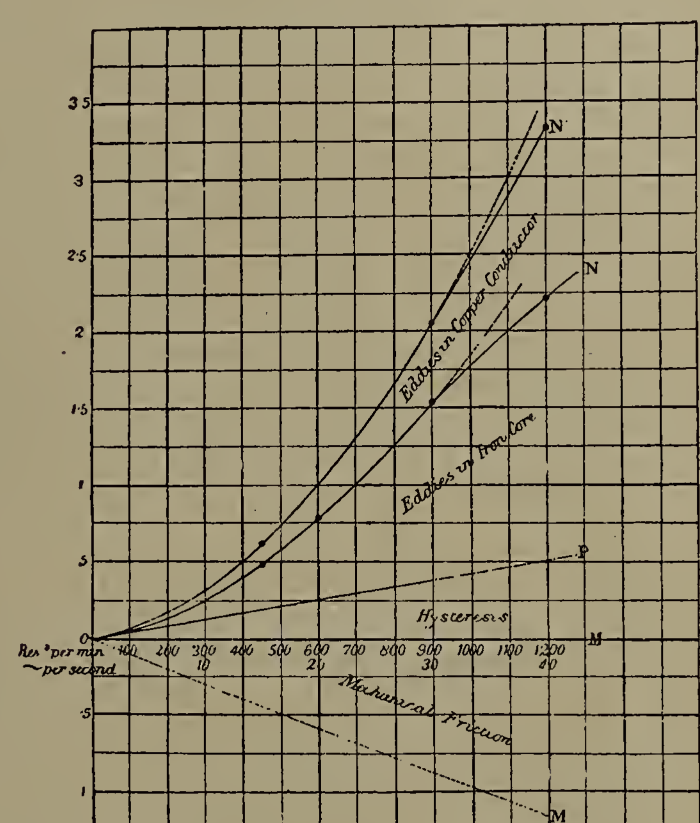


FIG. 24.

of the hysteresis effect has been supplied from an outside source.

The consideration of all these facts in their proper light may serve to guide the designer with greater certainty to his object. The opinion advanced by an authority on the subject has tended to assume hysteresis in an armature as taking place not in the direction of the plane of lamination but at right angles to it, thus possibly bringing in a new factor of reluctance to be calculated for in their design.

The law of hysteresis as stated in previous articles on the subject is perfectly true for values of an induction lying between 85 and 19,000 lines of force per square cm.

The additional loss due to Foucault or eddy currents in the core is of an entirely different nature from that due to hysteresis; it is due to the immediate effect of revolving a mass of metal, in this case iron, in a magnetic field producing electric currents of the above name.

(*To be Continued.*)

Suit.—The Consolidated Traction Co., of New Jersey, has been sued by Mrs. Masterson to recover $20,000 for the killing of her husband, John Masterson, in Jersey City last December by a trolley car.

THE MONOCYCLIC SYSTEM.*

BY DR. LOUIS BELL.

It is quite common to find alternating stations with a plant efficiency considerably below 50 per cent. and in which the regulation is maintained only within, perhaps, about 10 per cent. Under these circumstances it is small wonder that the advocates of the direct current, the uses of which as an engineering problem have been very completely worked out, have been often somewhat violent in their animadversions on alternating currents in general. Nevertheless, in the last two or three years there has been a vast change for the better in alternating practice, a change not yet rapid, but bidding fair to be far-reaching. This change has taken up a threefold path toward progress:

First, the use of large transformers is becoming more frequent.

Next, these transformers are more and more used in conjunction with systems of secondary mains; and, finally, it is now possible to install an alternating plant that shall be able to operate motors as successfully as can be done with direct current. Not only can motors now be successfully worked off alternating circuits, but off a wide variety of such circuits. As yet, however, there is no successful motor for use on the simple alternating system which has, for the most part, been installed in this country. While it is possible to construct a single-phase motor even for 120 to 130 cycles per second, the frequency most used in America, it is at present very doubtful whether such a motor can be made to start and run in a way which will be generally satisfactory. Abroad, where low periodicities are used, better results may be obtained, but even there there is a noticeable silence on several important points in describing alternating motor practice. Appearances indicate that even with the advantage of low frequency motors for use on simple alternating circuits still start badly, and particularly require enormous currents at the moment of starting; hence the growth of various modified alternating systems, of which the polyphase is the best known, by the use of which it becomes possible to avoid this difficulty entirely and to work alternating current motors in every respect as satisfactory as those operated by direct current.

The polyphase motor has solved the problem of securing good motor service with alternating currents in a very complete manner, although at the cost of slight complications, which, while generally over-estimated, are nevertheless distasteful to central station men, especially where the use of such a system would involve an extensive and costly rearrangement of the distribution service. It is the purpose of this paper to call your attention to the various methods of central station distribution, involving motor service on the alternating current system, and more especially to a modified single-phase alternating system, which lends itself very readily to a very simple and straightforward distribution for lighting, without sacrificing the excellent motor service, which makes the true polyphase systems so desirable. For all-around central station work the lighting service is of most fundamental importance, and convenience and economy in this particular must, in a vast majority of cases, be the first consideration. Let me invite your attention to this chart, which shows in a diagrammatic manner the general arrangement of various alternating circuits, including those already familiar and the polyphase and monocyclic systems.

First in order, both of time and extended use, comes the simple alternating system, single-phase, with an ordinary two-wire distributing circuit. In operating the secondaries of such a system, we run immediately into limitations imposed by the feasible voltage for lamps, limitations which have acted as a brake on alternating current work and which are responsible for a good many difficulties in the operation of alternating plants. Opposite the diagram of this circuit I have placed the relative amount of copper required for lighting with such a distribution.

Next comes the alternating circuit modified for Edison three-wire distribution, which is so familiar in its character that it needs no description here. The amount of copper needed, on the supposition that neutral is half the size of either of the others, is, of course, enormously reduced, amounting, as you see, to less than one-third of that needed with the two-wire system; consequently, the secondary main distribution, so important to economical operation can be carried out with the greatest facility. We are justified at present in saying that neither of these systems lends themselves to the ready operation of motors.

We may next consider the two-phase alternating system worked with four wires, giving, if desired, two separate circuits for each machine. The copper here required is the same as that used with the single-phase, and so long as the four wires are kept together motors can be freely operated. Here is assuredly a step in advance. The operation of two separate circuits, however, from a single machine, involves certain complications. In the first place, unless these circuits are balanced as to load, the operation of the system is somewhat difficult to make satisfactory in point of regulation. The circuits themselves have absolutely no influence on each other, but they are derived from the same machine, and with a given excitation of that machine, unless the loss in the two circuits is the same, the voltages must necessarily be different, consequently the generator cannot be compounded for both circuits unless the circuits are balanced. There are three ways out of this difficulty; none of them, unfortunately, is altogether unobjectionable.

In the first place, one can make the loss on the line so small that the difference in voltage due to any reasonable difference in load is of no moment. This can sometimes successfully be done, but more often it involves a very unnecessary cost for copper, and even at its best is likely to give regulation which, although better than that found on most simple alternating systems, is yet not good enough to suit the requirements of the best modern engineering.

Second, the machine can be compounded for loss on one of the lines, a feeder regulator being used on the other. This practically means hand regulation of one circuit.

Or, finally, both circuits can be operated by such regulators. In any case, if motors are to be operated, the two phases must be interlinked at least by one wire.

A somewhat simpler two-phase distribution is that shown in the next diagram, where the two phases unite into a common three-wire circuit. The amount of copper here required differs very materially, according to the limitations of voltage that one chooses to fix. If the maximum voltage of the system is limited to the same maximum voltage used on the single-phase two-wire or two-phase four-wire system, the amount of copper required is very largely increased by the use of the third wire, owing to the fact that the two circuits combined are out of phase with each other by 90 degrees. The relative amount of copper required here is, as you see, 145.5. If, on the other hand, the question of maximum voltage between wires is neglected and the voltage is determined by the use of lamps of the same voltages as on the other systems, then the amount of copper is materially reduced, being a trifle less than three-fourths of that required on the systems before mentioned. In this case, we neglect the fact of there being an excessive voltage between the outside wires, and connect lamps between the middle wire and the two outside ones, much in the manner of an Edison three-wire system, with the exception, of course, that the saving in copper is not anything like the same amount. Such a system allows the distribution of the whole loads for lights and power in a single circuit containing only three wires. It therefore avoids the difficulty of regulating two separate circuits. On the other hand, it causes a new and very curious difficulty, owing to the fact that the two combined phases are unsymmetrical with regard to the inductance of the system. The voltages between the middle wire and the two outside wires are unequal, when the systems are equally loaded, by an amount depending on the inductive loss on the line. Consequently, when in balance for regulation, the system is

* Abstract of paper read before the National Electric Light Association, Cleveland, Ohio, February 20, 1895.

unbalanced as regards the load on the two sides, a condition which, although it may not lead to trouble in some cases, is still a menace to the successful operation of the system, unless the distribution be skilfully engineered. There is, however, the possibility of a noticeable saving in copper.

We may next pass to the three-phase alternating system. The system which corresponds to the two-phase four-wire system I pass by, as the use of three separate circuits would be even more troublesome than that of two, and would have no compensating advantages. The ordinary three-phase circuit is that shown in the figure wherein the three phases are united into three wires, and taken everywhere where the motors and lights are wanted. In this case, for the same voltage between wires, the amount of copper demanded is just three-fourths of that demanded for a single-phase two-wire or two-phase four-wire circuit. To compensate for this, there is the possibility of unequal voltages in case the three legs of the circuit are unequally loaded, owing to interaction in transformers and in the generator. So far as inductance on the line is concerned, the system is symmetrical and balanced.

If the load on the three branches is very unequal, as, for example, if one branch is entirely unloaded or very lightly loaded, while the other two are worked to their full capacity, there will be a perceptible unbalancing of the voltage. Experience, however, shows that with anything like the same care in balancing that would apply to an Edison three-wire system, this theoretical difficulty of balance is absolutely negligible. I say this advisedly, as the question has been so often raised that I have taken pains to investigate the conditions in three plants operating lights with reference to this particular thing, and the statement just made is the result of actual practice. It might be thought at first sight that good results could be obtained by combining with either a two-phase or three-phase system the Edison three-wire distribution. As a matter of fact, such a system would be unreasonably complicated with either two or three phases, as any central station man will readily appreciate, inasmuch as it would be necessary to have two or three-wire systems, each balanced, and mutually balanced with respect to each other, covering the territory if motors are to be run, or at least interlinked in a somewhat complicated way.

There is, however, a three-phase system which does secure a very great advantage in copper. This is the three-phase four-wire system shown in the figure. It consists of the ordinary three wires employed on the three-phase system, with the addition of a balance wire proceeding from the common connection of the generator or the transformer and forming a part of the general distribution system. The lights are, as can be seen from the diagram, connected between either of the three-phase wires and the balance wire. Between each of the outside wires there is, therefore, what may be considered two lamps in series, having, however, a phase difference of 120 degrees. The voltage of transmission, then, between each of the three main wires is 1.73 times the voltage employed in the lamp connected, nearly 200 volts for 110-volt lamps. This necessarily means a large saving in copper, which is still further enhanced by the fact that the three-phase three-wire system requires intrinsically only 75 per cent. of the copper used on the single-phase or direct current system. The total result with this particular connection is but 29½ per cent. of the copper required on the single-phase system, supposing, as in the Edison three-wire distribution, the neutral wire to be half the size of either of the others. Such a system is in successful use at St. Hyacinthe, Canada, in connection with long secondary mains. The price paid for this saving in copper is the introduction of a fourth wire into the distributing system.

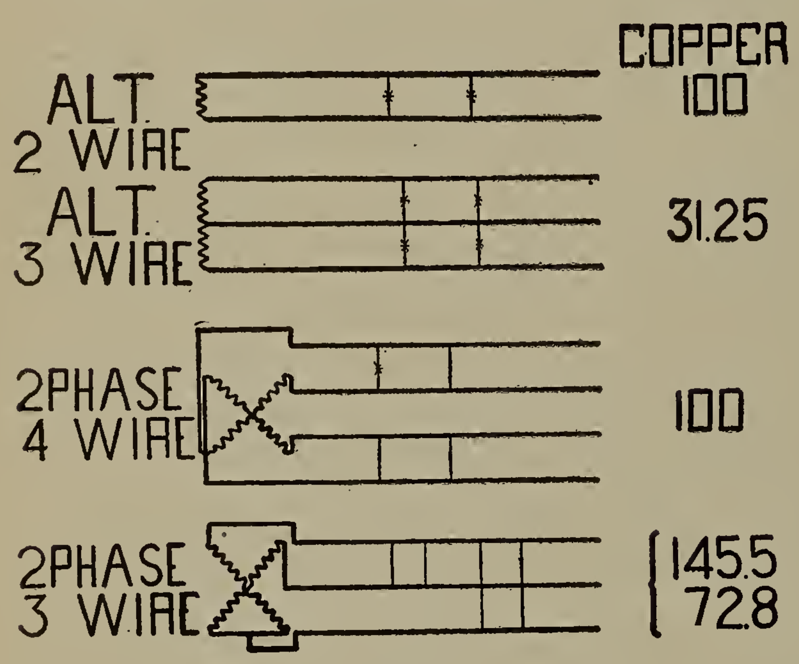
Comparing, then, the lighting distributions on the two and three-phase systems, we find that if three wires only are used, both save very nearly the same amount of copper. The extreme voltage between wires on the two-phase circuit is, however, considerably greater, and both are liable, but not likely, to become unbalanced.

There is this difference, however, that if we are to balance a three-phase system in respect to voltage, we need only to see that the load is equally distributed between the three branches. If we are to balance a two-phase three-wire system, we must see that the load is unequally distributed between the three branches by an amount depending on the inductance of the line. We therefore see, comparing the polyphase with the single-phase system, that the price we have to pay for the privilege of successfully operating motors is a certain amount of complication in circuits, which, while not of great importance in new installations, hinders the ready adaptation of a polyphase system in a plant having already a large number of circuits installed. Attractive as the single-phase is in its beautiful simplicity of wiring, we cannot yet successfully run motors from it. It was for the purpose of preserving that simplicity of distribution which is peculiarly valuable in connection with large central stations, especially those already installed and joining to this the same ability of running motors found on the polyphase system, that the monocyclic system, to which I am about to call your attention, has been perfected. You see it first in its two-wire form. Here, so far as the lighting distribution is concerned, it is absolutely identical with any of the alternating systems now installed in simplicity, convenience and in the amount of copper necessary. The main circuit of the monocyclic machine constitutes a simple, single-phase alternator, and, so far as the lighting on the system is concerned, is identical with it, connected in precisely the same way, feeding if desirable, into the same circuits without change. There is, however, on the armature of the monocyclic machine a supplemental coil, shown on the diagram as connected to the middle point of the main winding on the monocyclic machine, from which a power wire may be led. This need be of but small cross section and only has to be carried to those points in the system at which it is desired to operate motors, and, as I shall presently show, this power wire enables one to run motors possessing the same desirable characteristics as the polyphase motors, and, indeed, generally identical with them, without in any way distributing the lighting distribution, except in so far as Ohm's law is a necessary limitation on all combined power and lighting circuits. In the last diagram here, we see the same device applied to an Edison three-wire system for the distribution of lights, along with which is carried the same insignificant power wire, which permits the successful operation of motors. The value of the three-wire feature in the distribution of lights is evident, the amount of copper being the same as in an Edison system of the same voltage. With this monocyclic system we can compound the generators for any reasonable loss in the line, and can arrange the lighting system without incurring any troublesome questions of balance, so as to give as good regulation even as can be obtained on a direct current system. Beyond this we have the power of running motors.

It is instructive to glance over this list of alternating lighting systems to see their relative complexity and advantages. It is especially noteworthy that any and every method of distribution that saves copper introduces in some form or other the question of balance. This is the price we pay for reduction in cost of conductors. It has not seriously interfered with the use of the Edison three-wire system; in fact, those most familiar with that system were the first to make light of the difficulty; nor do I think it stands as a valid objection to the use of the polyphase systems in cases where they are desirable, as none of them are more sensitive in the matter of balance than the Edison three-wire system which is now in such extensive and uniformly successful use. We may further note that in each of the alternating systems, where a very great saving of copper is accomplished, a fourth wire is necessary, at least if both lights and motors are to be operated, in each case, however, of trifling size.

Having now looked over the field in general, we may pass to the more minute consideration of the somewhat striking electrical peculiarities of the monocyclic system; peculiarities which, although they do not involve any particular complexity, are yet of decided interest. The general

principle of the system is well shown in this diagram. So far as the main work of the generator is concerned, its winding is closely similar to that of any well-designed alternator. The armature is of the iron-clad type, and the winding is made in machine wound coils, which are invariably insulated and can be very readily slipped into place. There is, however, upon the armature a second set of coils of cross section equivalent to that of the main coil, but composed of comparatively few turns, so that the room taken up on the armature is very small, and owing to the shallowness of the slots necessary to accommodate this second or teaser coil, the output of the machine, considered as a single-phase generator, is not affected. This teaser coil is located with reference to the main coil as shown in the diagram. Its place on the armature is midway between the other coils, and the electromotive force generated is in a direction at right angles to that of the principal coil It is evident, now, that if we connect the terminal of this teaser coil with either of the terminals of the main coil we shall get an electromotive force compounded of the two and in some intermediate direction. In general, by varying the proportions of the two coils, and hence their electromotive forces, we could obtain a resultant electromotive force between their terminals having



any angle we pleased with either the main or the teaser coil. If, then, wires are taken upon the line from the terminals of the main coil and also from the teaser coil, we can obtain from the main line three electromotive forces, two of which are symmetrically situated with reference to the electromotive force of the teaser coil, and bear to it any phase relation that we please. One of the most convenient arrangements, and that which is most generally adopted, involves such a relation of the electromotive force of the teaser coil to that of the main coils, that we shall have on the line three electromotive forces approximately 60 degrees apart In other words, the resultant electromotive forces between teasers and main coils are each 60 degrees from the electromotive force of the teaser coil. Such an arrangement is that shown in the diagram. Under these circumstances it is clear that, if one of these electromotive forces were reversed, either in transformers or anywhere in the translating devices, the result would be three electromotive forces 120 degrees apart, one of them having been turned through an angle of 180 degrees. Meanwhile the relation between the power wire, which is connected to the teaser coil, and the outside wire has no effect upon the electromotive force between these outside wires, since the electromotive force of the main coil itself does not interact with the power wire, except in so far as a portion of it may act with the power wire to form a resultant phase, and electromotive force for running motors Consequently, so far as lights are concerned, the two outside wires behave precisely like the leads from any other alternating generator, while so far as motors are concerned, we have the power of getting our three electromotive forces 120 degrees apart, and hence have the same magnetic effect as with a three-phase system. The arrangement of light and motors with this device is clearly shown in the diagram.

(*To be Continued.*)

TWENTY PER CENT. DUTY ON ELECTRICITY.

A dispatch from Ottawa, Ont., says that the Comptroller of Customs has decided that electricity comes under the head of unenumerated articles, and consequently bears a duty of 20 per cent. The question arose over a proposition to transmit power from the American side of Niagara Falls to surrounding Canadian cities.

MR. RICHARDSON'S WISE COUNSEL.

Mr. William J. Richardson, secretary of the American Street Railway Association, and of the New York State Street Railway Association, and a Director of the Atlantic Avenue Railroad Co., Brooklyn, N. Y., enjoys the esteem and confidence of street railroad employés in general in Brooklyn. Mr. Richardson is the president of the Atlantic Aid Association, which is a benefit organization composed of employés of the company above named, and his influence for good was markedly emphasized during the recent strike in that city.

At a recent meeting Mr. Richardson addressed the society. During his remarks he referred to the duty of the members in their relations to the public as strikers. He counselled them to abstain from violence themselves and to use their influence to prevent violence on the part of other strikers.

Mr. Richardson stated there were three parties concerned in the condition of affairs during the strike—the public, the railroad companies and the employés. The primary cause of the trouble, he said, was the public, through their representatives in the Senate and the Assembly. It is from the public that the railroad companies receive their corporate life, particularly by special acts of the Legislature. The people's representatives are chosen secondarily, by the voters, but primarily by the politicians in the primary.

The people living in a free country, he said, have it within their power to send men to represent them in legislative halls, who, "like Cæsar's wife, shall be above suspicion." So long as American citizens neglect the primary, from apathy, carelessness, thoughtlessness, mistaken idea of being contaminated by association with the men who believe that "to the victors belong the spoils," and who measure their political interest by that standard, just so long will the people be misrepresented in law-making assemblies.

The treatment received at the hands of the people through their representatives is not honest; it is most unjust.

The ingenuity of the Legislature is taxed to its utmost to conceive ways in which to draw the very life-blood out of a street railway company.

The company is taxed on its capital stock, on its gross earnings, its dividends, its real estate, its tracks, and finally must pay a license for running its cars over its own rails above a pavement it does not use, though it has paid for it, as well as between tracks and two feet outside thereof.

Why, let me ask, should the State have a different system or basis of taxation for corporate property from what it has for individual property?

But again, every year as anyone knows who knows anything, bills, suggestively called "strikes," aimed at the very heart of street railway corporations, are introduced in the Legislature by the representatives of the people.

The railroad companies and their employés, he thought, were less guilty of sin than the public, and, in conclusion, he advised the members to do their whole duty as American citizens and esteem the duty a privilege.

New Books.

Elementary Lessons in Electricity and Magnetism. By Silvanus P. Thompson. New Edition revised throughout with additions. Macmillan & Co., New York and London, 628 pages; 295 illustrations. Price $1.40.

This work first made its appearance in 1881, and has always been regarded as a standard. It leads the student on imperceptibly by degrees, towards a full knowledge of the electrical science in all its applications, and the knowledge acquired from a study of the book comes so easily that when the student stops to pause and ascertain his progress he is astonished to find himself so far advanced without being aware of it. This, no doubt, is due to the clear manner in which Dr. Thompson expresses what he desires to impart to other minds.

The new edition brings everything up to date, and the book is infinitely more desirable than ever. It is a work that is as valuable to the practical electrical engineer and electrician as to the student, and it is one of the few books that have been regarded as indispensable to a serviceable library. Every subject has been enlarged in its treatment and among the new chapters added is one on Electric Waves. The chapter on alternating currents and alternating current apparatus is especially valuable in its comprehensiveness.

Those who now possess a copy of the original work should by all means get a copy of the new. It is the crystallization of the electrical science, and contains everything one wishes to know regarding electricity.

Street Railway Investments, A Study in Values. By E. E. Higgins, Street Railway Publishing Company, New York. Price $2.00.

This work was written with the idea of determining just what measure of success has been achieved during the three years covered by the investigation by horse, cable and electric railway systems in cities of various sizes. From the statistics obtained the author has tried to predict in a conservative manner the probable limits of gross and net earning power under different conditions of traffic.

Some valuable statistics are given, and as the work has been prepared without prejudice it may be regarded as a safe guide in the study of street railway finances.

Electrical Boats and Navigation. By Thomas Commerford Martin and Joseph Sachs. 224 pages and 98 illustrations. C. C. Shelley, New York. Price $2.50.

The application of electric power to the propulsion of boats has engaged the attention of many inventors during the past few years, and considerable progress has been made in this direction. The most notable example of this use of electricity was at the World's Fair, where electric launches successfully navigated the water-ways all through the fair period. The literature relating to electrical navigation has heretofore consisted of separate articles in various domestic and foreign papers, without any real connection with each other. In this work, however, this scattered information has been crystalized and brought within the limits of one book. The book will, therefore, be valuable to those interested in the new art, being the first of its kind. It brings the development of electrical navigation up to date, and is full of valuable data and statistics which will form the basis for further advancement.

This application of electric power, as all know, is in a transitory state, and is not yet settled on a firm foundation, but the authors hope that the book may subserve the needs of the present moment. It is surprising to learn how much work has been done in this new art, and it shows unmistakably that there is a great future for electrical navigation.

The book is commended to all interested as an excellent work of reference, and it will no doubt meet with a large demand, as there has long been a call for such a work.

American Street Railway Decisions.—Vol. 2. American Street Railway Association.

It is expected that this work complete will require six volumes to bring it down to date. It is sold to subscribers at $5 a volume, net, delivered. It contains a collection of all reported cases decided in the various courts within the United States and Canada, chronologically arranged. The work is edited by Charles A. Richardson and Alfred J. Hook, both lawyers of Brooklyn, N. Y. A valuable subject index is given. This work is one of exceeding value to street railroad companies. These concerns cannot afford to be blind to the action of the courts regarding suits affecting street railways. Every single decision bears more or less upon the affairs of all street railway companies, and it is to the interest of all concerned to keep posted in these matters.

ENERGY DISTRIBUTION BY ALTERNATING CURRENTS.

At the regular monthly meeting of the New York Electrical Society, held at Columbia College on the night of March 7, Mr. Charles S. Bradley read a paper on "Alternating Currents in their Relation to Energy Distribution." In the absence of President Mailloux, Prof. M. I. Pupin presided.

Mr. Bradley, in an extremely interesting manner, traced the evolution of the distribution of energy by alternating currents of electricity, and supplemented his remarks by a practical illustration of the operation of a three-phase induction motor and other alternating apparatus. The lecture was further illustrated by various diagrams sketched on the blackboard showing the starting torque, the various losses and the efficiency of the three-phase motor referred to.

An interesting discussion followed the reading of the paper, in which Professors Pupin and Crocker, Dr. Emery, Jos. Sachs and others took part.

NEW RAPID TRANSIT ROUTES FOR NEW YORK.

On February 16 the Rapid Transit Railroad Commission held a meeting, at which considerable material work was accomplished. The following resolutions were adopted:

That this board does hereby adopt the following routes for rapid transit railways in the city of New York, and hereby determines and establishes the said routes as follows, namely:

A route, the centre line, commencing at a point under the westerly side of Whitehall street, distant along the same 62.5 feet north from the northerly line of South street produced, thence by diverging lines under Whitehall street and Battery Park and State street, forming a loop line, the tracks converging to parallelism at a point at or near the westerly side of State street and the southerly side of Battery place; thence under Broadway and Union Square to Fifty-ninth street; thence under the Boulevard to a point at or near Ninety-third street; thence by viaduct along the Boulevard to a point at or near One Hundred and Eleventh street; thence under the Boulevard to a point at or near One Hundred and Twenty-third street; thence by viaduct along the Boulevard to a point at or near One Hundred and Fifty-first street; thence under the Boulevard to a point at or near One Hundred and Fifty-sixth street; thence by viaduct along the Boulevard to a point at or near One Hundred and Fifty-ninth street; thence under the Boulevard to One Hundred and Sixty-ninth street; thence under Eleventh avenue to a point at or near One Hundred and Eighty-fifth street.

Also, a loop from Broadway, under Mail street, City Hall Park, Park Row and Chambers street, and again connecting with the Broadway line.

Also, a route, the centre line of which shall diverge from the Broadway line at or near Fourteenth street, and run

under Union Square to Fourth avenue; thence under Fourth and Park avenues to a point at or near Ninety-eighth street; thence by a viaduct along Park or Fourth avenue to the Harlem river; thence turning to the right by bridge across the Harlem river, and thence to the left until it shall coincide with the centre line of Walton avenue produced at or near its intersection with One Hundred and Thirty-eighth street; and thence along the line of Walton avenue to a point at or near One Hundred and Forty-sixth street.

And it is further

Resolved, That the said routes by these resolutions adopted shall, upon the same being consented to as provided in section 5, chapter 4, of the Laws of 1891, be and be deemed to be in lieu of the routes heretofore adopted as aforesaid by this board and its predecessors, and that thereupon such portions of the said routes so heretofore adopted as are not coincident with the routes by the present resolution adopted be and be deemed abandoned.

Resolved, That it is the sense of this board that in addition to and in extension of the routes adopted there should, as soon as possible, be adopted further routes running north to the city line on the east and west sides thereof.

At a subsequent meeting further resolutions were adopted providing, among other things, that the tunnels shall not be less than 12 feet in height in the clear, and shall be 12½ feet in width for each track except at unusually narrow places. Viaducts shall be built with a width of 12½ feet for each track. Provision shall be made for the placing of pipes, wires, sewers, and other sub-surface structures in suitable galleries, either at the side or beneath the tracks, or both.

The general mode of operation shall be by electricity or some other power not requiring combustion, and the motors shall be capable of moving trains at a speed of not less than 40 miles per hour for long distances, exclusive of stops.

Telephone Notes.

A telephone system is to be established in Rockland County, N. Y. Mr. M. F. Colgrove, Nyack, N. Y., is interested in the enterprise.

The Phœnix Telephone Company, of Indianapolis, has obtained a franchise in Carthage, Mo.

Thos. J. Suter, of Palmyra, Mo., is interested in a company recently organized in that place to establish a telephone system.

A telephone exchange is to be established in Elkin, N. C.

E. C. Drowne, of Harriman, Tenn., is interested in a lately organized co-operative telephone company in that place.

It is stated that Mr. G. Milton Blair, of Hanover, Pa., will manufacture improved telephones. He is now looking around for a site for a plant.

The Reading, Pa., council has granted permission to the Pennsylvania Telephone Company to lay underground conduits in that city.

The Phœnix National Telephone Company, of Indianapolis, Ind., will establish a system in Pittsburgh, Kansas. About 200 subscribers have been secured.

TELEPHONE PATENTS ISSUED, MARCH 5, 1895.

Telephone Apparatus—Otto L. Wullweber, Chicago. (No. 535,042.)

Battery Telephone Transmitter.—William W. Jacques, Newton, Mass. (No. 535,247.)

Telephone Transmitter.—John Goodman and Henry M. Goodman, Louisville, Ky. (No. 535,284.)

Telephone.—William W. Jacques, Newton, Mass. (No. 535,289.)

Combined Telegraph And Telephone System.—Christopher A. Shea, Boston, Mass. (No. 535,299.)

NEW TELEPHONE COMPANIES.

The Indiana Telephone and Construction Company, Indianapolis, Ind., by Messrs. Clabaugh, of Indianapolis, R. B. Campbell and Chas. Selden, of Baltimore.

The Fulton Chain Telephone and Telegraph Company, Boonville, N. Y., by B. Sperry and D. F. Sperry, of Old Forge; Jas. Higby and F. A. Higby, of Big Moose; Dennis Cannon, of Chase's Lake.

The Dalton Telephone Company, Dalton, Ga., by S. P. Madox, C. D. McCutcheon, and J. C. Bivings.

The Spartanburgh Telephone Company, Spartanburgh, S. C., by J. T. Calvert, J. T. Jennings, W. M. Jones and others. Capital stock, $10,000.

The Union Telephone Company, Union, S. C., by W. D. Arthur, W. A. Nicholson, T. C. Duncan, W. E. Thomson, W. S. Arthur and Geo. Oetzel.

The Hampton Telephone Company, Hampton, Va, by W. E. Lawson, M. C. Armstrong, H. W. Saunders and Jac. Heffelfinger.

New York Notes.

Office of the Electrical Age,
World Building, New York,
March 11, 1895.

The Gamewell Fire Alarm System will be installed at the Cotton States and International Exposition, which will be held in Atlanta, Ga., next fall.

The Interior Conduit and Insulation Company will on March 15 move its headquarters from 44 Broad street to its works, Nos. 527–531 West 34th street, city.

McLeod, Ward & Co., 91 Liberty street, New York city, have taken the agency for the Dayton electric ceiling fans made by the Dayton Motor Co., Dayton, Ohio. McLeod, Ward & Co. will have the exclusive agency for New York.

The annual meeting of the Commercial Cable Co. was held early last week. The annual statement showed that over 10 per cent. was earned on the stock during the year. Seven per cent., or $700,000, was paid in dividends, and $310,439 was carried to the surplus fund. The company is now entirely free from bonded debt. Its plant is worth $12,250,000, while its capital remains at $10,000,000. Directors were elected, and the Board afterwards re-elected as officers the present incumbents. The Board also declared the usual quarterly dividend of 1¾ per cent., payable April 1.

W. T. H.

New Corporations.

The Citizens' Electric Light and Power Co., Newark, Ohio, by Wm. G. Traafel, Wm. D. Fulton, and others. Capital stock, $30,000.

Sigourney Electric Light and Power Company, Sigourney, Iowa.

The Freeport Light and Fuel Co., Freeport, Ill., by Chas. D. Knowlton, Louis Stoskopi, and others. Capital stock, $100,000.

The Northwestern Telephone and Construction Co., Osage, Iowa, by H. J. Fitzgerald, C. H. McNider and H. C. Baldwin. Capital stock, $50,000.

The Manhattan Electric Storage Battery Co., New York, N. Y., by August Belmont, Jas. H. Hoffman, Louis Stein, and others. Capital stock, $600,000.

The Swans Island Telephone and Telegraph Co., Augusta, Me., by H. P. Jones, H. W. Joyce and H. W. Small. Capital stock, $8,000.

The North Manchester Telephone Co., North Manchester, Ind., by A. D. Mills, J. W. Mills and C. L. Arthur. Capital stock, $5,000.

The Franklin Electric Illuminating Co., Sea Cliff, L I., N. Y., by Samuel Stenson, John Graham, W. A. Porter, D. W. Pardes, of Sea Cliff, and others. Capital stock, $25,000.

The Queens County Telephone and Telegraph and Supply Co., Oyster Bay, L. I., N. Y.. by W. L. Swan, G. W. Feller, Samuel Y. Bayles. Capital stock, $20,000.

Batavia Street Railway Co., Batavia, N. Y., by Amos H. Stephens, A. B. Wilgus, J. H. Wilgus, J. S. Lindsay, C. C. Marsh, of New York city, H. R. Burdick, of Malden, Mass., E. P. Wilgus, and others. Capital stock, $75,000.

The Montgomery Electric Co., Ambler, Pa., by E. A. Murphy, R. L. Parkinson, A. M. Slouchein and Henry Parker. Capital stock, $1,000.

Possible Contracts.

H. M. Howard, of Palmyra, Mo., will organize a stock company to erect an electric light plant in that place.

Jos. J. Hooker, Webster, N. C., proposes to build a telephone line and wishes prices on equipment therefor.

John W. Tabor, Shreveport, La., is interested in a new telephone company in that place.

It is proposed to build an electric railway between Ellsworth and Surry, Me.

Fire destroyed the barns of the Lansing Street Electric Railway Co., Lansing, Mich. Several cars of the company were destroyed. The loss is $25,000.

A movement is on foot to establish an electric light plant in Sabina, Ohio.

It is proposed to construct an electric railroad between Salamanca and Little Valley, N. Y.

A municipal electric light plant in Aitkin, Minn., is contemplated and a vote will be taken on the question.

The wood-working factories of Hood, Gale & Co., Warren, Pa., were destroyed by fire recently. They will be rebuilt.

M. F. Colgrove, Nyack, N. Y., is organizing a telephone company to build lines in Rockland county.

W. Carly Ely, of Niagara Falls, N. Y., has been granted a franchise to obstruct a trolley road through North Tonawanda.

Thos. Craig and others, of Geneva, N. Y., has purchased the Geneva & Waterloo Electric Railway and will make extensions and improvements.

The Albany & Castleton Electric Railway Co., Albany, N. Y., has applied for a franchise.

The Boyds Telephone Co., Boyds, Md., is in the market for supplies.

New Machinery is to be installed in the electric light plant at Water Valley, Miss. Mayor G. D. Able can give further particulars.

Webb City, Mo., has sold $15,000 in bonds for an electric light plant. The mayor can give further particulars.

A new opera-house is to be built in Charleston, S. C. The Exchange Banking and Trust Company has charge of the subscription books.

The Southern Express Company will soon build a $150,000 office building in Memphis, Tenn.

Smith & Bready, of Baltimore, Md., it is said, have the contract to build the Annapolis and Bay Ridge Electric Road.

H. W. Sexton is interested in a plan to build an electric railway in Anniston, Ala.

The Baltimore, Middle River and Sparrows Point Electric Company, Baltimore, Md., intends to extend its lines in Baltimore county.

The Columbia Street Railway Company, Columbia, S. C., proposes to make several extensions on its line.

The Georgetown and Tennallytown Electric Railroad, Washington, D. C., has been bought by a New York syndicate, including Oscar T. Crosby and C. A. Lieb. These gentlemen, it is said, will be president and vice-president respectively. The lines are to be improved.

The New Haven Electric Light Company, New Haven, Conn., has applied to the legislature for permission to extend its system.

The Fort Wayne Electric Corporation, Fort Wayne, Ind., has applied for permission to erect a plant in Wilkesbarre, Pa., for the distribution of electric power.

The Dexter and Brownsville Street Railway Company, Watertown, N. Y., by Byron B. Taggert, Hiram F. Inglehart, of Watertown and others. Capital stock, $40,000.

The Palestine Electric Light Company, Palestine, Tex., by John R. Hearne and others. Capital stock, $20,000.

Sealed proposals will be received at the office of the clerk of the Board of Control, Cleveland, Ohio, until March 16, for furnishing electric motors, submarine cables, etc., for operating a new bridge in that city. J. H. Farley, director of public works, may be addressed.

Trade Notes.

Mr. John C. Boss, Elkhart, Ind., has purchased the interest of Charles A. Hornberger in the Hornberger Electric Manufacturing Company, of that city. This gives Mr. Boss absolute control of the business. Mr. Boss first became interested in the company two years ago, since which time the business of the company has greatly increased. This was the result of the energy put into the business by Mr. Boss.

Mr. Jerome L. Boyer, general manager of the Metropolitan Electric Company, Reading, Pa., writes in a very complimentary manner regarding the belts made by C. A. Schieren & Co., of New York. Mr. Boyer says that he has used the Schieren belts for the past five years, and that they have given entire satisfaction. Mr. Boyer says he has used other belts, but Schieren's have proved the most satisfactory.

The F. & W. Manufacturing Company, of 757 Broadway, is making a curtain-pole, which is finished by the electroplating process. The poles are of artistic design. They are placed in an electro-bath, and plated as electric light carbons are, solutions of different metals being used to produce the various colors. These poles are now sold by the largest houses in the country, and artistic household decorators and architects specify them in their plans. They are made to match the wall-paper and other decorations of a room. The president of the company is Dr. J. B. DeLery, who is well known in electrical circles ; Ellis Wooster is secretary, and Mark Fishel is treasurer and manager.

WOVEN WIRE BRUSHES.

The Belknap Motor Co., of Portland, Maine, are the patentees and manufacturers of the best woven wire commutator brush on the market.

Electrical and Street Railway Patents.

Issued March 5, 1895.

535,010. Transformer. Fred S. Hunting, Fort Wayne, Ind. Filed Feb. 25, 1892.

535,027. Rheostat. Alton J. Shaw, Muskegon, Mich., assignor to Mary H. Shaw, same place. Filed Dec. 1, 1894.

535,042. Telephone Apparatus. Otto L. Wullweber, Chicago, Ill. Filed Jan. 7, 1893.

535,051. Electric Arc Lamp. Harry P. Davis, Pittsburgh, Pa. Filed Oct. 23, 1893.

535,052. Electric Arc Lamp. Harry P. Davis, Pittsburgh, Pa., assignor to the Westinghouse Electric and Manufacturing Company, same place. Filed May 3, 1894.

535,077. Circuit Interrupter for Alternating Electric Currents. Henry N. Potter, Allegheny, assignor to the Westinghouse Electric and Manufacturing Company, Pittsburgh, Pa Filed Feb. 28, 1894.

535,078. Street-Car Pilot John J. Rhine, Pittsburgh, Pa., assignor of two-thirds to Frederick W. McKee and Samuel Kelly, same place. Filed Nov. 6, 1894.

535,084. Insulating Conduit for Electric Conductors Lewis B Stillwell and Charles F. Scott, Pittsburgh, Pa., assignors to the Westinghouse Electric and Manufacturing Company, same place. Filed Oct. 25, 1894.

535 086. Lightning Arrester. Alexander Wurts, Pittsburgh, Pa., assignor to the Westinghouse Electric and Manufacturing Company, same place. Filed Feb. 28, 1894.

535.090 Electric Battery. Horatio J. Brewer, New York, N. Y. Filed May 2, 1892.

535,104. Armature Winding Machine. Harry E. Heath, Windsor, Conn., assignor to the Eddy Electric Manufacturing Company, same place Filed May 15, 1894.

535,165. Fender for Street-Cars. Bicknell Hall, Taunton, Mass., assignor of one-half to Edward P. Coleman, same place. Filed Sept. 25, 1894.

535,168. Street-Car Seat. John Krehbiel, Cleveland, Ohio. Filed March 26, 1894.

535,173. Drying Electric Cables. Charles H. Rudd, Chicago, Ill, assignor to the Western Electric Company, same place. Filed April 18, 1892.

535,184. Safety Fender. Myron J. Amick and Johannes Roos, New York, N. Y. Filed Feb. 16, 1894.

535,199. Incandescent Electric Lamp. Frank L. Fowler, Philadelphia, Pa. Filed July 30, 1894.

535,214. Contact Device for Conduit Electric Railways. Frank E. Lodetti, Rondout, N. Y. Filed May 4, 1894.

535,221. Automatic Protecting Fender for City Railway Cars. William H. Page, Burlington, N. J. Filed Aug. 20, 1894.

535,247. Battery Telephone Transmitter. William W. Jacques, Newton, assignor to the American Bell Telephone Company, Boston, Mass. Filed June 22, 1894.

535,284. Telephone Transmitter. John Goodman and Henry M. Goodman, Louisville, Ky. Filed Sept. 19, 1894.

535,289. Telephony. William W. Jacques, Newton, assignor to the American Bell Telephone Company, Boston, Mass. Filed May 26, 1892.

535,294. Closed Conduit for Electric Railways. Patrick Murphy, Chicago, Ill. Filed Jan. 9, 1894.

535,297. Sectional Conductor System for Electric Railways. Alfred Rosenholz, San Francisco, Cal., assignor of one-half to Samuel J. Clarke and Harvey S. Brown, same place. Filed Oct. 11, 1894.

535,299. Combined Telegraph and Telephone System. Christopher A. Shea, Boston, Mass. Filed Jan 3, 1893.

535,303. Motor Truck. Elmer A. Sperry, Cleveland, Ohio, assignor to the Sperry Electric Railway Company, of Ohio. Filed June 5, 1893.

535,304. Mounting for Electric Motors. Elmer A. Sperry, Cleveland, Ohio, assignor to the Sperry Electric Railway Company, of Ohio. Filed April 13, 1894

535,321. Electric Heater or Rheostat. James H. Delany, New York, assignor to Ezra T. Gilliland, trustee, Pelham Manor, N. Y. Filed Nov. 23 1894.

535,324. Electric Railway Conduit. William T. Dulany, Jr., New York, assignor of one-half to Oscar F. Shaw, Brooklyn, N. Y. Filed Dec. 14, 1894.

535,336. Electric Lamp Support and Cut-Out. Lafayette Johnson. New Albany, Ind, assignor of one-half to John H. Stotsenburg, same place. Filed April 5, 1894.

ELECTRICAL AGE

Vol. XV., No. 12. NEW YORK, MARCH 23, 1895. Whole No. 410

Established 1883.

Entered at New York P. O. as second-class matter, January 18, 1891.

THE ELECTRICAL AGE PUBLISHING CO., Publisher

TERMS OF SUBSCRIPTION:

One Copy, one year,	$3.00
One Copy, six months,	1.50
Great Britain and other Countries,	4.00

Cable Address (all Cables,) "Electage," New York.

W. T. HUNT, President. F. N. BASSETT, Vice-President.
T. R. TALTAVALL, Secretary and Editor.
NEWTON HARRISON, E. E., Scientific Editor.

ADDRESS ALL COMMUNICATIONS TO
THE ELECTRICAL AGE PUBLISHING COMPANY,
First Floor, World Building.
NEW YORK.

NEW YORK, MARCH 23, 1895.

CONTENTS.

SYMPATHY FOR MR. TESLA.

Mr. Nikola Tesla has a host of friends and admirers in his chosen profession, all of whom sympathize with him in the recent loss by fire of all his valuable electrical and experimental apparatus. Fire is like all the other elements, in that it is no respecter of persons. From one point of view the loss seems irreparable, but no doubt a duplicate of everything lost in the fire is stored away in Mr. Tesla's brain, and before long he will have them all materialized again. Fire cannot impede the progress of such a man as Mr. Tesla:

A BIG SCHEME.

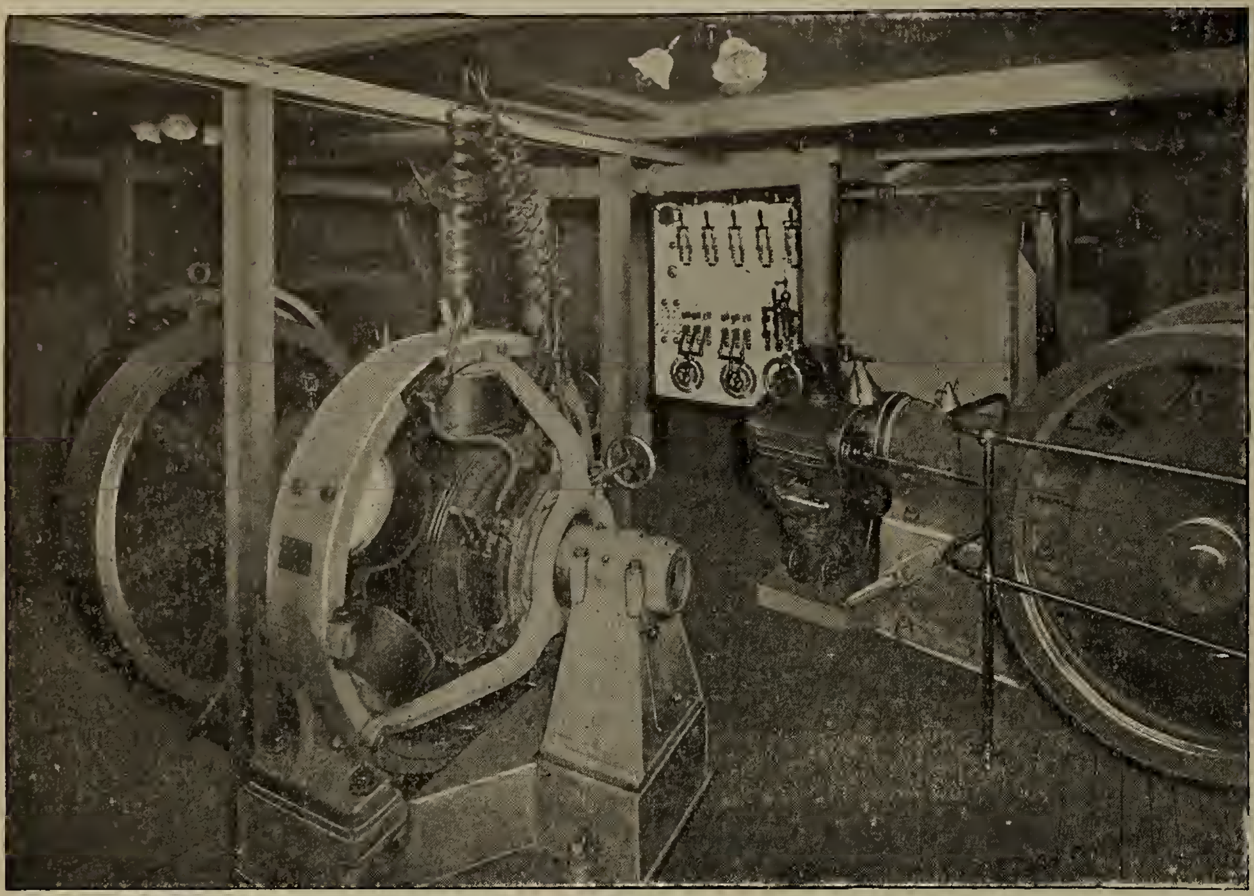
It is reported from Norwalk, Conn., that the New York, New Haven and Hartford Railroad Company has consummated plans looking to the purchase of several street railroads in various places along its lines in Connecticut. Among the street railroads mentioned in connection with the scheme are the Bridgeport Traction Company, the Norwalk Tramway Company, the Westport and Saugatuck Horse Railroad and the Westport and Southport Tramway Company. The New York, New Haven and Hartford, otherwise known as the "Consolidated" road, fears that the rapid increase of parallel trolley roads will affect its own short-distance traffic, and, in order to avoid such a circumstance, has, it is said, decided to buy up and control these disturbing elements. The company proposes, however, to develop the street railway properties, and use them, as far as possible, as feeders for its main line. It is reported that the street railroads named will soon pass into the control of the "Consolidated," and that if the plan of using them as feeders proves profitable the scheme may be extended so as to include all the street railroads between New York and New Haven.

LABOR vs. CAPITAL.

The conflict between the Wiremen's Union and the Electrical Contractors' Association is still on, with no prospects of an early adjustment, as far as appearances promise. The contractors are determined to maintain their position, and state that if they should yield to the men's demand their business would have to be conducted at a loss. Since the organization of the Wiremen's Union, five years ago, the men have been forcing the contractors to their terms until now, when a halt must be called. A large number of buildings are in process of erection and contractors cannot jump their rates at a moment's notice to suit the whims of some walking delegate. The men demand better terms, and contractors refuse to accede, because, having made their contracts on a certain basis, at a very small margin of profit, they cannot afford to yield. This is the situation. The men no doubt think they are right, but they do not always consider the contractors' interests. They know nothing of the hard work necessary to secure a contract, and the competition that must be overcome. The workmen get work and their pay regularly, but the contractor has to provide both, and only those who have tried it know the difficulties that stand in the way of accomplishing this result. The workmen would be bettering their own interests if they considered those of their employers more. The contractors, for their own protection, are compelled to band together to fight the labor unions, and the two interests, that should work in harmony, really stand toward each other in the relation of bitter enemies. Our sympathies are always with the workingmen. We have often reiterated the opinion that as a rule they get little enough for their labor, but the employer has interests to protect as well. Complicate the employers' affairs and the workman is deprived of his work and his pay. Is it not better, therefore, for each to consider the other's interests more than is done, when there is a disagreement between the two? A strike is a decidedly unsatisfactory way to settle a dispute, but so long as there is an absence of harmony between the two parties in interest, so long will troubles occur. The way to avoid strikes is to establish more confidence in each other between the contending parties, and confidence is based on honesty and justice.

THE ELECTRIC LIGHT PLANT ON THE PRISCILLA.

What is probably the most complete electric marine plant in the world, considered from the mechanical, electrical and artistic standpoint, is that of the steamer Priscilla, of the Fall River Line.



DYNAMO ROOM ON THE PRISCILLA.

The Priscilla was added to the Fall River Line's fleet of elegant steamers last June. She is the largest steamer of her class in the world, and is by far the most elegant in her fittings and furnishings. The Fall River Line is noted for its splendid steamers, and each new one that is added to the fleet always represents the highest development in marine architecture, both as regards construction and furnishing.

No expense is spared to make the steamers beautiful and attractive, and it is evident that the public appreciates all the efforts put forth in its behalf, as this line is by far the most popular that runs between New York and Boston.

In the fitting out of the Priscilla great care was bestowed upon the electrical plant, with particular reference to producing the most artistic effects. The result is a triumph of the electrical art, as the accompanying illustrations will show. These, however, give little idea of the real beauty of the work. It must be seen to be fully appreciated.

To begin with, the generating plant is the natural starting-point. It is the most extensive isolated marine plant ever installed. It consists of three 50-kilowatt General Electric multipolar generators, connected directly to Harrisburg Ideal 10x12 engines. Each pair of engines and generators is mounted on one bed-plate, and the three sets of machines are arranged radially with reference to a central space in front of the switchboard. The working parts of the engines are so perfectly balanced that there is hardly a tremor when the machines are running at full speed.

Each generator has a capacity of 400 amperes at 125 volts, running at 275 revolutions per minute. The armature windings consist of copper bars embedded in slots in the body of the armature. The brushes are moved by means of a hand-wheel.

The switchboard is of white marble, with a mahogany frame, and is an excellent example of the perfection obtained by the General Electric Company in this branch of its work. Three fire-proof field regulators stand at the back of the board, and these are operated by a like number of hand-wheels at the base in front. On the front of the board are three dynamo switches, flanked by two voltmeter switches, and above these are five main switches. A Weston illuminated dial voltmeter and three 450-ampere circular dial ammeters are arranged on the upper portion of the board.

The vessel is wired throughout on the two-wire system.

From the switchboard five feeders run to the main deck, and at four points of the vessel risers mount to the upper decks. These are connected to the circulating mains, one of which is on each deck, by means of four centre of distribution safety-fuse holders to each circulating main. At six points in each circulating main, whence the smaller wires branch off to the state-rooms, saloons and dining-rooms, are set marble cut-out panels. These panels are of special design, and each has its own peculiar form to fit into the position it can most conveniently occupy. They are provided with knife-blade switches, which bring the current to two pair of flat copper strips, between which are set fuse carriers of porcelain. Connection is made behind the board with a snap switch on the front for every circuit.

QUARTER-DECK, STEAMER PRISCILLA.

There are twenty-five of these panels. The two largest—one in the engine-room and the other on the gallery deck—have twenty-four circuits each.

The lighting throughout is so arranged and divided that

ten lamps on each circuit is the limit of the load on that circuit.

All the wiring appliances are those of the General Electric Company, and meet insurance and government requirements.

All junction boxes, switches, cut-out boxes, etc., used on the deck and other exposed places are absolutely waterproof, and are all finished in black. In all parts of the vessel where the wiring is exposed to moisture, the wire is lead-covered, and all the wire larger than No. 6 B. & S. is stranded. Forty-five miles of wire in all is used in the vessel, and in accordance with American marine practice, wires are used for the return circuits. The wire used is a special white core marine wire, manufactured by the General Electric Company, with insulation consisting of, first, a layer of pure Para rubber; next, a layer of rubber containing no sulphur, then a layer of vulcanized rubber containing 30 per cent. Para rubber.

The attention of the reader is now directed to the illumination of the steamer.

On the quarter deck eight stanchions, or round pillars of steel support part of the saloon deck above (see illustration). Each stanchion has a capital of light made up of a polished ornamental brass tulip, the petals of which are of opalescent glass. In the interior are twelve incandescent lamps. At night these lights give a soft and beautiful effect.

In the elegant dining-room (see illustration), which is also on the main deck, each window is surmounted by a box with stained glass front and sides. Each of these boxes contains ten 16 c. p. lamps, the light from which has the effect of sunshine passing through stained glass windows.

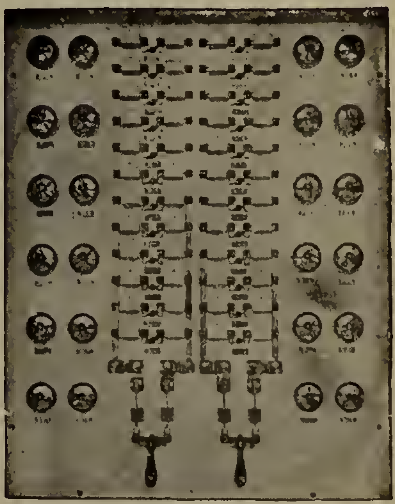
Similar glass receptacles are placed over the doors and mirrors at each end of the room. The ceiling is finished in beams and straps of mahogany, and paneled. Each panel has a medallion in the centre, and each alternate panel an electric pendant. This pendant is an elliptical bowl of opalescent glass, held in a rope net of brass and containing two 16 c. p. lamps. There are six rows of these stretching from end to end of the dining-room. On each side of the sideboard at the after end are two niches, in front of each of which hangs a basket pendant of opalescent glass enclosing an incandescent lamp.

MAIN SALOON OF STEAMER PRISCILLA.

Still further aft, on each side, are two private dining-rooms, each lighted by five elliptical bowl fixtures, a large one in the centre, and one in each corner, set in the panel immediately over the table.

The lights in the dining-room are controlled from two panel switchboards. These control not less than 350 lights—all in this dining-room.

DINING-ROOM, STEAMER PRISCILLA.



PANEL BOARD.

The stairway to the main saloon is lighted by three opalescent centre fixtures set in the arch. The lighting of the saloon, other than from the dome, is effected by three eight-light electroliers set between the stanchions and a

series of two-light brackets between the state room doors.

The mast passes up through the saloon and carries a highly ornamental fixture at the height of the gallery deck. In this fixture, branches bend down and out from a central band, and carry at their terminals frosted incandescent lamps set in opalescent globes.

State-rooms, lighted by one-light brackets, open out on either side of the saloon and gallery.

The principal feature of the lighting of the saloon is the central fixture, which takes the form of an inverted dome of brass work of complex pattern, in which are framed panels of opalescent glass. This is dependant from the ceiling half way between the bulkhead of the gallery staircase and the mast. Within this inverted dome are 48 incandescent lamps. It occupies in the ceiling the centre of a quadrangular medallion, at each corner of which is a much smaller inverted opalescent dome. Further aft are two other smaller inverted domes. In the forward saloon two eight-light electroliers are the main features.

The lighting of the gallery saloon is carried out on a plan similar to that of the main saloon. In addition it has one twelve light electrolier in the forward saloon, and a row of twelve incandescent lamps around the mast.

The lighting of the decks and all other parts of the vessel in which the public is not supposed to penetrate, is effected by means of lanterns, some hung as pendants, others arranged horizontally against the ceilings, and all protected by cages. Wherever moisture can reach them they are provided with water-tight globes and sockets. In addition to the lights just mentioned, there are the side, masthead, bow and stern lights.

Altogether there are 1,987 lights on the steamer, divided among 229 circuits. The entire electrical equipment was installed by the General Electric Company, and the lighting fixtures were designed and constructed by the General Fixture Company, of New York.

The following are the general dimensions of this magnificent steamer: Length over all, 440 feet; breadth over guards, 93 feet; breadth of hull, 52 feet; depth of hull, 20 feet; tonnage, 5,398.

STEAMER PRISCILLA, OF THE FALL RIVER LINE.

FIN DE SIECLE SCIENCE.

The following thermo-dynamical problem is stated and solved by an engineer: "A boy eats two ounces of ice. Let us sec what is the approximately thermodynamic equivalent of the work he has made his interior do, assuming he takes five minutes to eat it. In melting the ice he will require eighteen units to reduce it to water. To raise it in temperature to that of his inside he will require seven more units, or a total of twenty-five British thermal units. Taking the mechanical equivalent as 777 foot pounds, this will be equal to 19,425 foot pounds. If the boy weighs 100 pounds, he will have called upon his stomach to do as much heat work as would, with a machine having unit efficiency, raise him 194 feet high, or a rate of heat extraction equal to nearly an eighth of a horsepower."

Question—What becomes of the boy?

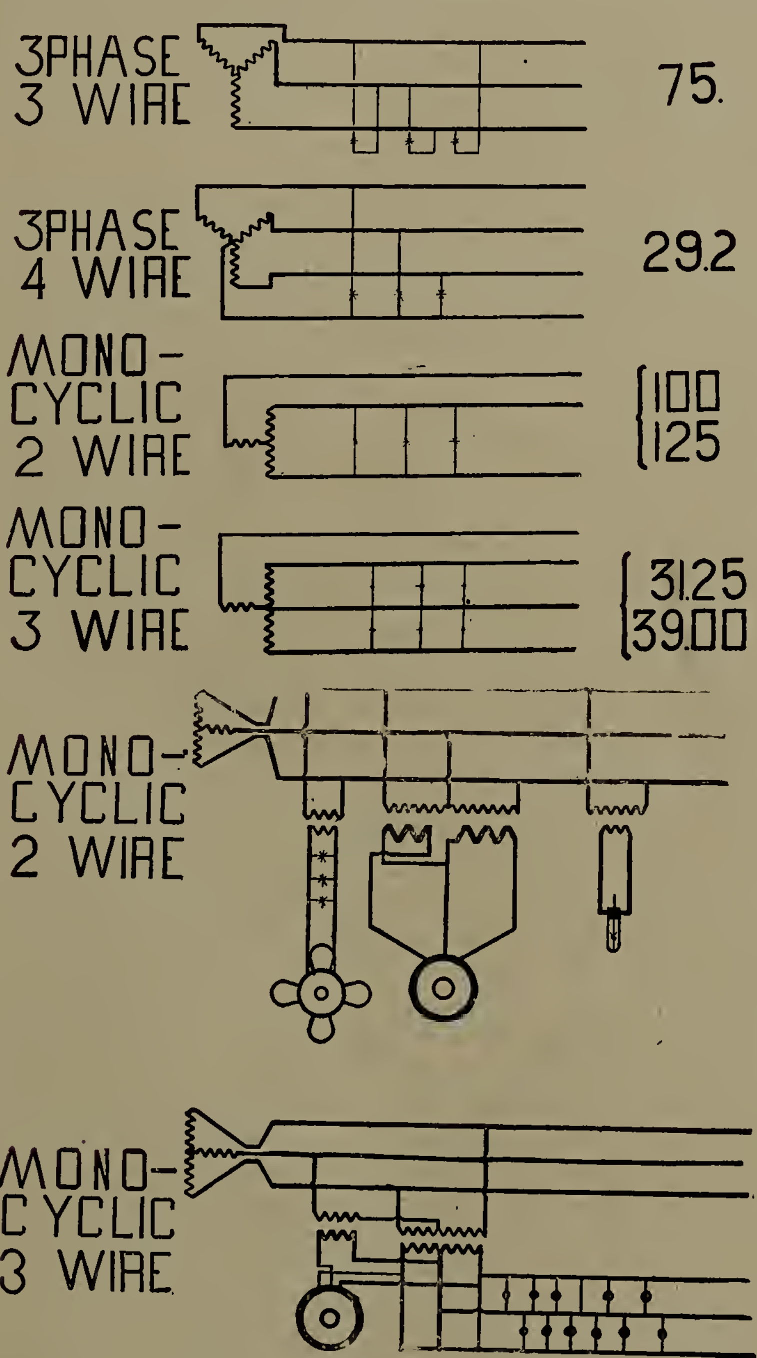
The People's Telephone Co. has applied for a franchise to open a telephone system in Chattanooga, Tenn. Col. J. C. Duncan is general manager.

THE MONOCYCLIC SYSTEM.

BY DR. LOUIS BULL.

(*Continued from Page 158.*)

It is evident that we can take from the outside wires of the monocyclic system either arc or incandescent lights anywhere and to any extent the capacity of the machine permits, working for the incandescents either two or three wire distribution at option. For a motor, two transformers are connected anywhere we please, one between the power wire and each of the outside wires. At this point the resultant phases come into play and the necessary reversal of one of the electromotive forces is accomplished by the very simple and obvious device of reversing one of the secondaries, as shown in the diagram. To the secondary circuit thus constituted we can connect a standard induction motor, which will start and run as well as



if connected to a regular three-phase system, or instead of reversing one of the transformer secondaries we may accomplish the same virtual reversal of the electromotive force by reversing one of the coils in the motor itself. We therefore have a system which, so far as lights are concerned, is a simple alternating system; so far as motors are concerned, the dynamical equivalent of a polyphase system. With a differently proportioned transformation we could place upon the secondaries two electromotive forces 90 degrees apart, if necessary, and then run two-phase motors instead of three-phase motors, if there were any object in so doing. Such an arrangement, however, would be less desirable than that of the quasi three-phase system, for the reason that without gaining anything in the motors we should have to generate a larger electromotive force in the teaser coil, and hence take up more room on the armature with it, perhaps enough to have an effect upon the output of the machine considered as a single-phase generator. It is sufficiently evident that the method shown would not be the only way of getting the same result. For example, in this second diagram a somewhat different arrangement is shown accomplishing precisely the same end. Here our object is to operate secondary mains on the Edison three-wire system, and in connection with them to run motors at any point we please. A large transformer to which the secondary is connected on the three-wire system is, therefore, installed, and the secondary mains distributed in any manner we please. A second and small transformer, proportioned to the total amount of motor service desired, is connected, as shown in the diagram, and the power wire leading from it is taken through the whole or part of the three-wire system. The device is analogous to the arrangement of the generating coils themselves, and the result is the ability to operate a standard induction motor by connecting it anywhere on the three-wire system to the two inside wires and to the power wire. Such an arrangement as this is immensely convenient in distributing power and light in cities where, for example, it is desired to establish an extensive system of secondary mains through Edison tubes or other convenient underground distribution. It is, furthermore, interesting to know that one is not confined to the use of either two or three-phase induction motors, since a monocyclic generator connected to the primary circuit makes an excellent synchronous speed without the assistance of a starting motor, in this particular being vastly superior to the pure single-phase synchronous machine. But it may be asked, how about this power wire? In case, for example, of a transmission over a considerable distance before the distributing point is reached, must the power wire be part of the transmission system? In answer, I need only call your attention to the fact that the essential point of the monocyclic system, so far as motors are concerned, is the establishing of an electromotive force bearing the same relation to the system as is borne by the teaser coil of the generator. Consequently, in case of a transmission plant, the main generators at the distant station may be simple single-phase machines, the subsidiary electromotive force being furnished by a synchronous motor or similar device at any point in the system. So we might readily have an extensive transmission with a monocyclic machine in the sub-station of such size as is necessary to furnish current for what motors may be upon the system. The power wire would then run only to the sub-station. Another interesting peculiarity of the monocyclic system, and one which is not without importance in case of an extensive power distribution, is the following:

Under ordinary circumstances induction and synchronous motors are wound so that the counter-electromotive force affects the system in a perfectly symmetrical manner, and the current flows over all the wires with some degree of symmetry in response to the demands of the motors on the system. It is customary, however, in the monocyclic system to employ motors so wound as to throw a high counter electromotive force into the power wire when the motor is at speed and loaded, thereby reducing the normal current carried over the power wire to a purely nominal amount, and this can evidently be done without sacrificing much in the matter of starting, since at the start all the counter-electromotive forces in the motors are zero. We have, then, a motor system of a type really peculiar to the monocyclic system, in that each motor will start under the same conditions of impressed electromotive force as if it were a polyphase motor; while, when at speed and loaded, it would be operating virtually as a single-phase machine. If, however, it were overloaded so that it would tend to slow down or stop, sufficient energy would flow over the power wire to bring it back to speed, just as if it were a polyphase machine. This is only one of various interesting ramifications in the system when developed to meet special conditions.

The connections shown in the diagrams, however, are those of the most direct applicability and probably which would be most extensively used for central station service. At this point it may be appropriate to ask, What is the dis-

advantage of such a system? It evidently secures exceedingly marked advantages in the ability to operate the lights on existing circuits or with the simplest possible kind of distribution, and at the same time to run at any point in the system synchronous or induction motors of well tried and familiar types. The question can be readily answered; in fact, the question is almost obvious. The price which we have to pay for this advantage is the installation of the power wire, which necessarily adds something to the weight of copper in the system and to the trouble of installation. Under all ordinary circumstances the power wire needs be of trivial cross section compared to that of the other wires, since, as a rule, the energy required for operating the motors from the given central station is small compared with the total capacity of the station; and further, it is worth remarking that the monocyclic motors, either synchronous or induction, will run perfectly well if the power wire is disconnected after the motor is at speed operating them as single-phase machines. It is, of course, well known that the single-phase synchronous motor gives admirable results, and it is also true that a single-phase induction motor can be constructed of excellent efficiency and other electrical properties. The only material difficulty in this case is to get the motor to start with a good torque. The monocyclic connection enables this to be accomplished. After the motor is at speed the power wire becomes no longer necessary to successful operation, so that in spite of the necessary existence of the power wire it is easy to see that the additional amount of copper is not likely to be burdensome in central station operation It would hardly ever be necessary to install a power wire of more than one-fourth the joint cross section of the others, as given in the diagram, and generally a much smaller wire will suffice.

DISCUSSION.

In reply to several questions raised during the discussion which followed the reading of the paper, Dr. Bell said:

The first question raised may be granted, that the monocyclic system is a modification of something. It is now to be considered as a single-phase or two-phase system, or a polyphase system of some sort. I think that question was clearly answered by Mr. Steinmetz when he pointed out that you must consider as a polyphase system one in which the energy remains constant—the common characteristic of all polyphase systems—whether evenly balanced or unbalanced. In the monocyclic system we have three currents substantially in phase with each other, and the total energy passes through zero. I fail to see how the widest possible extension of the definition of a polyphase machine could be made fairly to include it. The most that could be said would be that there might be a limiting case in which the unbalancing of a polyphase system might go on until the total energy would actually pass through zero. If that is so it might serve equally well as a limiting case for either the single phase or the polyphase system. It is certain that the monocyclic in its operation suggests a polyphase system. In the character of the currents which flow through it, and in the distribution of the energy it is peculiarly single-phase in its character. I was interested in Mr. Scott's remarks on the subject of the four-wire connection of the two-phase; and in the second place the three-wire connection of the two-phase system. Now, with a four-wire connection, it is, of course, possible to use the Edison three-wire system on each branch if one so desires; but in order to do so, and run motors at the same time, one must interlink the two three-wire systems; in other words you must have two three-wire systems, each system being approximately balanced as to itself, and each three-wire system balanced as respects the other three-wire system occupying the same territory. They must be interlinked for motor service, and that is the reason which, I maintain, bars out the two-phase four-wire system from employing the Edison three-wire connection, just as it must bar out in the same way, and even more effectively, the three-phase system from operating on each of its three phases an Edison three-wire system. It makes a complication of circuits for general distribution which would be perfectly intolerable, two three-wire circuits in the same territory, and each balanced with respect to the other—it would be something better imagined than described. In certain cases, for lights only, it may be applied, because you are at liberty to scatter your circuits; but even then it would require more or less balancing of the two systems, else you get into trouble with one side of the machine having a greater load than the other, which causes a difference in drop which cannot be compensated by compounding with the two-phase three-wire system. Mr. Scott's point was well taken on the question of maximum voltage. However, if you are dealing with the maximum permissible on the transmission line, where the thing to be considered is not the maximum on the distributing system to translating devices, but the maximum permissible on the whole system, and if you confine yourself to that, you will find that combining the two-phase into three wires requires excessive copper. If you confine yourself to the secondary system alone it will be possible to permit the same maximum voltage as on the straight Edison three-wire, and I should say that the same rule would apply to the reduction of copper in the three-phase three-wire system or any other systems, in varying degree, according to their character.

As regards the question of unbalancing, I think I stated, with a fair degree of distinctness, that with any polyphase system, though unbalancing may occur, and occur in a serious degree, I do not believe it would be a common occurrence. I think I specifically included the polyphase systems in general.

With regard to the question of the reduced capacity of transformers operating on three-phase or monocyclic systems; as a matter of fact there are three plans of working, we will say, with a three-phase system as regards its transformers; in the first place, we may have a composite transformer including all three legs of the circuits, which has been used with very fair results. Next, we may use three transformers, or, finally, only two transformers. Sometimes it is more convenient to use three, and sometimes two. We must remember that there are not to be had an infinite number of sizes of transformers, nor an infinite number of sizes of motors. The consequence is, it is sometimes a difficult matter to find transformers which will exactly fit a given horse-power of motor, and the loss of capacity which is thus met in furnishing transformers too large for the motors (because we must be sure to have them large enough) may easily amount to 10 or 15 per cent. either with two or three phases, and unless special transformers are made to fit the motors, we are liable thus to require an increased total capacity of transformers as well on two-phase as on three-phase systems. With the three-transformer connection for the three-phase circuit we have one very material advantage which perhaps makes it worth while to employ it in many cases, and that is if one of the transformers for any reason is crippled, we can operate at least two-thirds of the output with the remaining two; whereas on the two-phase system, if one transformer gives out the motor is crippled, either by overloading and stopping absolutely, or able to run at half output as a single phase-motor, but in no case starting until the transformer is fixed. If two transformers are used, the statement has been made that the loss in output in connecting three-phase transformers is about 16 per cent. I would like to see experimental evidence brought up in this case. We have been informed in many well-written technical articles that the output of the polyphase machine was thus and so in connection with a single-phase machine, and we know that the facts do not fully bear out the theory. We are now given similar information in regard to the transformers. While I am not prepared to dispute the fact without having experimented on it, I would like to see some evidence that the difference in output rises to any practical magnitude.

As regards the teaser transformer, I think we may consider the secondary transformer on the monocyclic three-wire system as practically part of the power wire. It needs to be of small size and furnishes only a small amount of energy. With that connection the one transformer fur-

nishes the power wire for the whole three-wire system. It is not a part of each motor, simply a part of a power wire, and as such it may be taken as a part of the installation belonging to the three-wire system. The single small transformer in the system furnishes the entire power wire for the whole system.

As regards the motor on the monocyclic two-wire system, it is correct in a sense to say that the motor does not know whether it is on a three-phase circuit or a monocyclic. As regards its operation, it does not know—that is, as regards the directions of the electromotive forces in it. It is a matter of perfect indifference which system it is on; but as regards the character of the currents and their direction, if the motor possessed an ammeter to put in its own coils, it would find there was a very large difference in the distribution of currents. As regards its magnetic qualities it would not matter, although the actual distribution of the current is widely changed. We have in the monocyclic induction motor a motor which, in its operative qualities, is like a polyphase motor. Nevertheless, the distribution of currents in it, although resulting in a perfectly symmetrical production of motive power, is something that you cannot find in any polyphase motor. It depends on the particular action used in the monocyclic system. It has essentially a single-phase current, although its effect as regards magnetism is closely similar to that of the true polyphase motor.

As regards the motor on the monocyclic three-wire system, I was much pleased with the ingenuity with which Mr. Scott constructed a large, able-bodied and well-dressed man of straw for the purpose of knocking the gentleman down and jumping on him with both feet. The motor is not a two-phase motor of any kind. It is an ordinary induction motor, such as is used indifferently on three-phase or monocyclic systems. Doubtless, from the experience of the speaker, he deeply realized how bad a bad two-phase motor could be. The winding of the monocyclic motor is, in every respect, similar to that of the three-phase motor. There is a possibility, and sometimes a great convenience, in being able to work a monocyclic generator as a synchronous motor. Used in such a way it works, during its operation, like any other synchronous motor. It is a possibility which is sometimes very convenient; the motor starts itself, and the teaser coil, when the motor is up to speed, produces no effect on the rest of the system if the motor is properly designed with reference to suppressing the electromotive force of the teaser circuit. In the moncyclic three-wire system we have, in the first place, a three-phase motor structure, but operating on a monocyclic three-wire and teaser circuit, with the properties and distribution of currents, or electrical character, of the single-phase system. The actual details of operation in a monocyclic motor are somewhat complicated. Substantially we have a structure which, in all its characteristics, is only proper to be operated on the monocyclic or three-phase circuits. The currents which flow through it, however, are not three-phase currents, the electromotive forces being, however, 120 degrees apart. The currents are substantially in phase, but the magnetism produced is so distributed as to give a perfectly symmetrical torque on the motor, just as though it was run upon a polyphase circuit; a point which I think justifies me in the remark that I made at the beginning, that the monocyclic system is to be regarded not altogether as a modified and glorified single-phase, nor again as a decrepit and disreputable polyphase system, but rather as a class by itself.

TENDENCIES OF RECENT ELECTRICAL RESEARCH.

Professor M. I. Pupin will deliver a lecture before the New York Academy of Sciences at 8 o'clock Monday evening, March 25, on "Tendencies of Recent Electrical Research." The lecture will be given in Hamilton Hall, Columbia College, corner Forty-ninth street and Madison avenue, New York. All interested in the science of electricity are invited to be present.

MR. TESLA'S LOSS.

The building No. 33 and 35 South Fifth avenue, New York, in which Mr. Nikola Tesla had his laboratory, was destroyed by fire early on the morning of March 13. Mr. Tesla's apparatus was completely ruined, and he had no insurance on his property. It is stated that several nearly completed inventions were destroyed.

Mr. Tesla for a long time past carried on his experimental work on the fourth floor of the destroyed building, but little information as to what was being done inside ever reached the public ear, so carefully were the secrets guarded. Mr. Tesla, it is stated, was greatly affected when he first heard the news of the fire and his loss. He has a wide circle of acquaintances in the electrical field, all of whom will sympathize with him in his misfortune.

Mr. Tesla, when asked the value of his apparatus destroyed, stated that it was incalculable in the true sense of the word, because what was lost was original and could not be bought in duplicate. The apparatus might represent a value of $1,000,000 and not cost $10,000 to make. As it was of that peculiar kind of property that has no market value, but represents a great value, no estimate of the pecuniary loss could be given. It is thought, however, from careful estimates that Mr. Tesla's actual loss will be anywhere from $75,000 to $100,000.

Mr. Thos. A. Edison very generously tendered to Mr. Tesla the use of his laboratory at Orange until he, Mr. Tesla, made other arrangements. This offer of Mr. Edison was deeply appreciated by Mr. Tesla.

Mr. Tesla is hard at work again on his new plans.

INSPECTION OF ELECTRIC METERS.

The following is a copy of the bill introduced into the New York Assembly last month providing for electric meters and inspectors thereof:

Section 1. The governor of this State shall nominate, and by and with the consent of the Senate shall appoint an inspector of electric meters, who shall reside in the city of New York, whose duty it shall be, when required, to there inspect, examine, prove and ascertain the accuracy of any and all electric meters used or intended to be used for measuring or ascertaining the quantity of electric light or power furnished by any electric light company in this State, to or for the use of any person or persons, and when found to be or made correct, to seal, stamp or mark all such meters, and each of them with some suitable device; such device shall be recorded in the office of the secretary of state; all such meters shall have exposed indexes, and so constructed that the public can read them.

§ 2. Such inspector shall hold his office for the term of five years from the time of his appointment, and until the appointment of his successor, but may be removed by the governor for sufficient cause; and he shall receive an annual salary of twenty-five hundred dollars to be paid in the first instance out of the State treasury on the warrant of the comptroller.

§ 3. Such salary shall be charged to and paid into the State treasury by the several electric light companies in this State, in amounts proportionate to the amounts of the capital stock of said companies, repectively, to be ascertained and assessed by the comptroller of the State; and in case such electric light companies, or any or either of them, shall refuse to or neglect to pay into the State treasury the amount or portion of said salary which shall be at any time by said comptroller required of them, respectively, for the space of thirty days after written or printed notice is given or sent by said comptroller to them, respectively, in the usual way by mail, to make such payment, then the said comptroller may be and he is hereby authorized and required to collect and recover the same from any such delinquent electric light company for its or either of their said portion or amount so determined to be due with interest thereon at the rate of ten per cent. per annum, from the time when said notice to make such payment was given, together with the legal costs, fees and

expenses of collection, in the name of the office of the comptroller under his seal, by warrant or warrants in the manner provided by the laws of this State, for raising and collecting taxes for the use of the State upon certain corporations, joint-stock companies and associations.

§ 4. It shall not be lawful for any corporation, company or person, at any time after this act shall take effect, to furnish and put in use any electric meter which shall not have been inspected, proved and sealed by said inspector, except during such time as said office of inspector shall be vacant, or said inspector, after request made, shall refuse or neglect to prove and seal the meters furnished for that purpose, and except the meters in use when this act takes effect, and which may be removed for examination or repairs.

§ 5. That every such electric light company shall provide and keep in and upon their premises a suitable and proper apparatus, to be approved and sealed by said inspector of meters, for testing and proving the accuracy of the electric meters furnished for use by said company, and by which every apparatus meter may and shall be tested, on the written request of the consumer, to whom the name shall be furnished, and in his presence if he desires it. If any such meter, on being so tested, shall be found defective or incorrect to the prejudice or injury of the consumer, the necessary removal, inspection, correction and replacing of such meter shall be without expense to the consumer; but in all other cases he shall pay the reasonable expenses of such removal, inspection and replacing; and in case any consumer shall not be satisfied with such inspection of the meter furnished to him, and shall give to the company written notice to that effect, he may have such meter reinspected by the State inspector (if he requires it) upon the same terms and conditions as above provided for the original inspection thereof.

§ 6. The inspector of electric meters is hereby authorized and required to appoint deputy inspectors of electric meters, said deputies to reside wherever electric meters are manufactured in this State, and who shall, in their respective places of residence, discharge the same duties as are required of the inspectors of electric meters, and shall be subject to the provisions of this said act, such deputies to be paid by the inspector out of his salary, hereinbefore mentioned at the rate of two dollars per day while actually engaged in the discharge of such duties, and to hold office during the pleasure of said inspector.

§ 7. On and after the passage of this act, it shall not be lawful for any electric light company in this State to charge or collect rent on its electric meters, either in a direct or indirect manner. Any person, party or company violating any of the provisions of this section, shall be liable to a penalty of fifty dollars for each offense, to be sued for and recovered in the corporate name of the city or village where the violation occurs, in any court having jurisdiction, and when collected to be paid into the treasury of said city or village and to constitute a part of the contingent general fund thereof. Meters must be furnished by such companies to consumers upon request.

§ 8. This act shall take effect immediately.

ENGLISH AND FRENCH CENTRAL STATIONS.*

BY H WARD LEONARD.

In London I visited several central stations of which I will mention two. The first is that of the Metropolitan Electrical Supply Co. This company has an enormous area allotted to it. I will explain right here, that both in London and Paris the authorities follow the plan of granting to several different central station companies—supply companies as they term them—the exclusive right to a certain section of the city. No such company can run into any other company's section. At the central station of the Metropolitan Company, I found four Parsons steam turbine units of 350 K.W. each, running at 3,000 revolutions per minute. These steam turbines had been in operation only a short time when I saw them, and had been installed for the reason that the central station had been enjoined by the courts from operating the reciprocating engines formerly in use because of the vibration they caused. I was informed that the vibration was particularly troublesome and difficult to overcome, because the central station was built upon made land, above the bed of a former river, and that the ground was boggy and transmitted any vibration in the most surprising manner. I inquired as to the working of the steam turbines and was informed that they were not able to detect any difference in their coal consumption compared with the compound condensing reciprocating engines formerly in use. I found that an accident had happened to one of the steam turbines by which it had lost all of the blades in one of the three chambers, which reduced its capacity and efficiency considerably, but did not put it out of service entirely.

The other London central station I shall refer to, is that of the City of London Company. This company supplies the heart of London, that is, the old "City of London," which is without doubt the best central station territory in the world, on account of the wealthy nature of the customers, the substantial character of the buildings, and especially because of the peculiarly dismal foggy weather in London. While I was there, artificial light was required almost as much by day as by night. This central station is beautifully located on the south bank of the Thames, near the centre of lighting, and is a fine example of the best that can be done today with the alternating system under such conditions. I do not believe it would be possible to find less excuse for the use of the alternating system than in this station, and yet I expect it will pay, for it can hardly fail to earn money under such extraordinarily favorable conditions for lighting.

But I need hardly say that they have no motors except toys, and but few of them; and when I remember that in Chicago 40 per cent. of the connecting load is motors, and that this percentage is rising all the time, it seems evident that the City of London Company is terribly handicapped by the use of the alternating current. However, they have a 2,000-volt three-wire secondary, and operate the dynamos all on multiple-arc, which is certainly using the alternating current to the best advantage. Aside from the use of the alternating current under these conditions, it is difficult to say anything in criticism of the central station.

The plant is arranged on the panel system, which Mr. Mordey says originated with him, and which is thoroughly carried out in this station, for each panel or section across the building comprises an independent unit including a boiler, engine, dynamo and switchboard for 500 K.W. The engines are vertical and direct-coupled to the Mordey alternators. The switchboards are entirely novel in design, being cast-iron pyramids about ten feet high, standing clear from the wall and having all of the conductors inside, with the instruments, etc., mounted on the front face. While very finely finished and ornamental, I could not but think that the vital parts would be more difficult to inspect and repair, in case of emergency, than in our recent switchboard practice.

One detail in electrical construction in which the foreign practice seems very backward is the rheostats. In this magnificent station, in the City of London, for instance, and in many other places, I saw rheostats made by winding German silver wire on a slab of slate, which was then mounted on insulators horizontally on a table, and a slider arranged to move over the surface of the resistance wire itself, which was thoroughly exposed.

Another detail in which we are certainly in advance of foreign practice is our instrument work, for which we must thank Mr. Weston solely. I saw many fine instruments while abroad, but they seemed to be more suited for a physical laboratory than a central station, the substantial compact permanent features of the Weston instrument, with its readable scale and dead-beat index, were conspicuous to me by their absence.

* Abstract from "Notes on Recent Electrical Engineering Developments in France and England" read at meeting of the American Institute of Electrical Engineers, New York, February 27, 1895.

In France the most interesting central station I saw was in Paris, where I visited a sub-station designed for a capacity of 30,000 lights. The sub-station was supplied from a distant central station by means of a constant current of 250 amperes, all devices on this current being in series, and the total E. M. F. running as high as 6,000 volts at times.

In the sub-station were rotary transformers, the primary ends of which were series-wound motors, and all being in series. The secondaries of these rotary transformers as generators, fed a five-wire system of conductors, and in multiple-arc with these generators across the five-wire system was a bank of storage batteries. The lamps used were 110 volts; some of the rotary transformers had 110-volt secondaries, four of such secondaries being in series, so as to make the five-wire system complete independently of the batteries. Other of the rotary transformers had 440-volt secondaries, and fed the outside conductors only. On each rotary transformer was a rheostat which was in multiple with the series-wound field, and which, by a step-by-step movement, similar to that of the old U. S. automatic regulator, controlled the strength of the series field so as to keep the E. M. F. in the secondary constant; the controlling magnet of the automatic being across the secondary of constant E. M. F.

The storage battery plant was well designed and seemed to be in good order. It was as clumsy and seemed as full of troublesome possibilities as those we have on this side of the water. It had capacity for 8,000 10-C. P. lamps for three hours. and cost about $30,000, weighed about 400,000 pounds, and occupied a space about 32x50 feet. This cost means about $107 per K W. of output, which seems a pretty high price to pay for a plant to generate electrical energy today, especially when it probably has an efficiency at three hours' discharge not above 60 per cent. Such a storage battery must be compard in cost with the cost of boilers, engines and dynamos per kilowatt, which would cost, perhaps, $50 per kilowatt, and whose efficiency would be 100 per cent. as compared with the 60 per cent. efficiency of the storage battery, since the storage battery must derive its energy from a steam plant first. The craze for storage batteries as the universal panacea for electrical troubles which we have all read so much about in connection with European practice, seems to be on the wane, if I may judge from the statements of the engineers, rather than the storage battery manufacturers, but when we remember that in France and England they do not know what a healthy motor load means, we need not be surprised at the claims of inefficiency for stations which do not use batteries, and hence run their boiler, engine and dynamo for most of the twenty-four hours practically without load.

THE AMERICAN STREET RAILWAY ASSOCIATION.

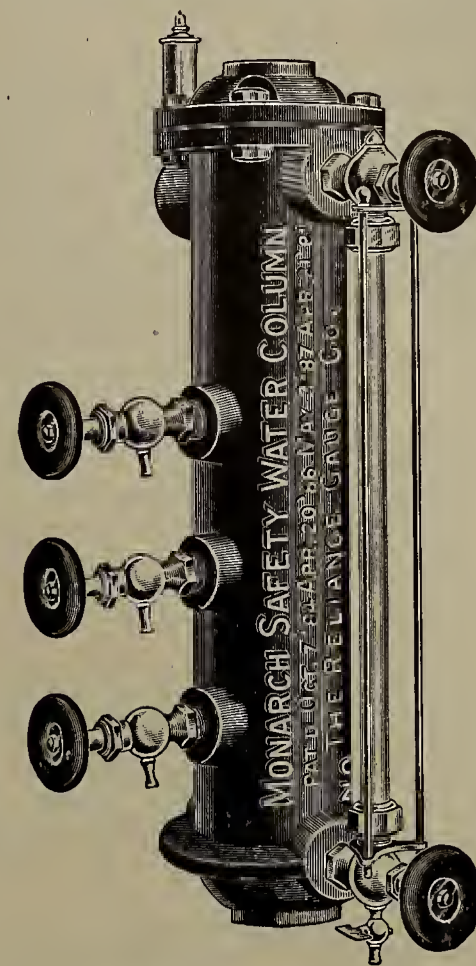
The Executive Committee of the American Street Railway Association, on February 27, last, held a meeting at the Windsor Hotel, Montreal, and did considerable preliminary work in connection with the next meeting of the Association, which will be held in Montreal next October. A list of local and special committees was prepared, and the titles of subjects were also selected.

The headquarters of the Association during the convention will be at the Windsor Hotel.

Fitness of Things.—One of our contemporaries symbolizes itself by an owl, and proclaims the fact that "We never Sleep." An owl is a nocturnal bird of prey, with a large head. Owls in all ages and countries have been regarded as of ill omen. Does the shoe fit? We do not think it is at all creditable for one to admit that he never sleeps. It implies a sore head and muddled brain, when both should be clear. The brain needs a rest. But, of course, if there is no brain, that is a different matter.

THE RELIANCE GAUGE COMPANY.

Among the allied establishments located in Cleveland which hardly needs introduction to the electrical industries, is the Reliance Gauge Company, the factory of which is located at 70 to 80 East Prospect street. This company

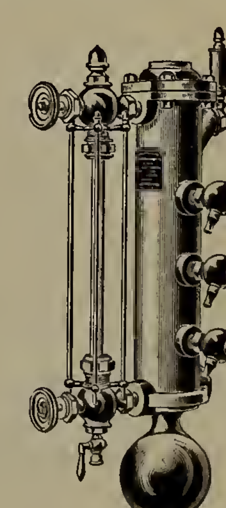


MONARCH WATER COLUMN.

manufactures many steam specialties, among them the well-known Reliance Safety Water Columns and the Monarch Safety Water Columns shown in the accompanying illustrations, both of which sound the whistle automatically whenever the water line reaches the prescribed limits for both high and low water. The Monarch Column is a new column made under the Reliance patents, on the same principle as the Reliance, and at a very much lower price.

The other specialties, manufactured by this company, in which all steam users are interested, are the Reliance Balance Steam Traps, which have a continuous discharge and work under any pressure, and have several distinctive

RELIANCE GAUGE.

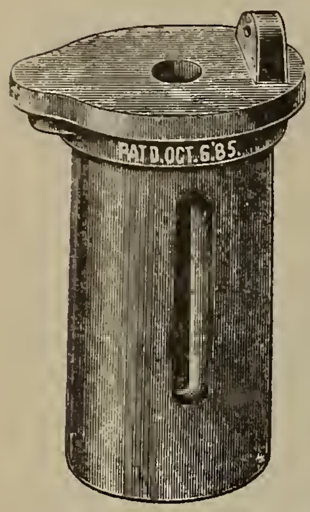


BALANCE STEAM TRAP

features, and the Reliance Steam Separators, the chief characteristics of which are that in the separation of the steam and water they allow the former to take its natural course upward, while the water likewise follows its natural course downward, thus forming a more easy and more perfect separation than is usually secured.

The officers of the company are: A. J. Wright, president; H. E. Higgins, vice-president; P. B. Huyette, secretary.

THE NEW YORK CARBON WORKS.



The accompanying illustration shows the celebrated carbon battery cylinder which is made by the New York Carbon Works under the patent right of Mr. Charles W. Holtzer.

These carbons are well known in the trade for their excellence of quality and their efficiency.

The carbon is provided with a cover which has an opening for the reception of the positive electrode and is extended over the edge of the jar to support the cup. The positive electrode is supported by an insulating bushing or sleeve placed in the opening of the cover.

The carbon has vertical openings down the side to admit of a free circulation of the electrolyte, and on account of its great surface gives a large current.

The patent under which these carbons are made was sustained by the Circuit Court of the United States District of Massachusetts, March 13, 1894, and the New York Carbon Works, 41 Cortlandt street, has the sole and exclusive right for manufacturing the goods.

This company makes a specialty of battery carbons and makes, also, granulated carbon, carbon dust and carbon brushes.

RELAXATION.

A man is a crank until he succeeds.

Teacher—Johnnie, what is wool?
Johnnie—Stuff what de pull over people's eyes wid.

Criticism is virtually telling the other fellow that he is wrong and that you are right.

A woman of ample avoirdupois was recently picked up by the fender of a trolley car in Baltimore. The motorman assisted her out and asked if she was hurt. "No;" she replied, "but please tell me, is my hat on straight?"

"Does the telephone give a shock?' she asked. "It depends upon who is at the other end," was his reply."

How to keep cool this summer—Don't get warm or use a fan motor.

"Yes, Smith lives by his pen!"
"Indeed; he looks as if he lived in one."

In England, the penalty for walking on a railroad track is arrest; in America, it is death.

"No work can be performed without some resistance being offered," explained Mr. Bighead.
"That fits me exactly," said Littlehead. "I offer a great resistance to work."

Truth cannot perish ; falseness cannot endure.

"O'im not much av a sphaker," mentioned the candidate, "but fer honesty, intigrity and capacity, I bate the divil, so I do."

"Is life worth living?" It depends upon the liver.

Smith to Mrs. Smith—All right, I'll come home this afternoon and we'll take a ride. I'll telephone you if I change my plans.
Later—Boy to Mr. Smith—"Mrs. Smith is at the 'phone and wants to know if you have changed your pants."

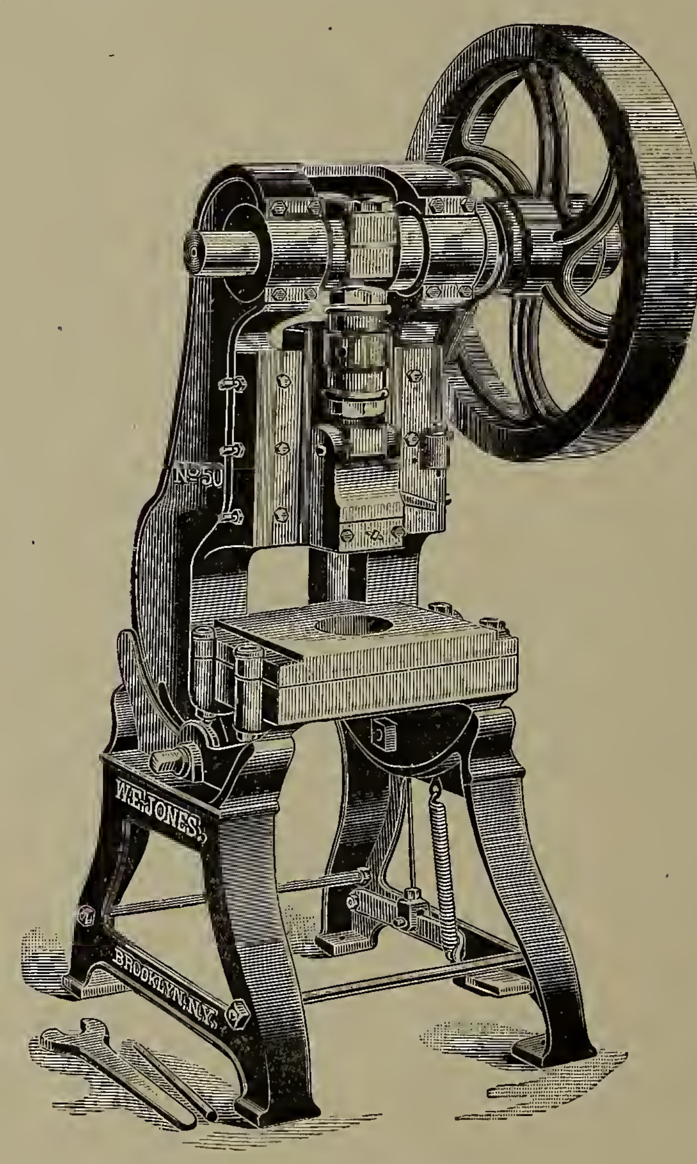
MR. COREY AGAIN ON DECK.

Mr. R. B. Corey, of incandescent-arc lamp fame, has again bobbed-up serenely. The collapse of the Electric Construction and Supply Co. left friend Corey free and independent to start out on a fresh tack, and the new ship has all the trade wind she can carry. Mr. Corey's many friends are glad to know that he has started out for himself in the manufacture of arc lamps for constant potential circuits and railway circuits, twin lamps, focussing lamps, etc. His new goods will embody the latest improvements and in design and manufacture they will be of the highest character. Mr. Corey will also handle a make of imported carbons which is celebrated for quality and long life. With him is associated Mr. J. C. Knight, the well-known inventor of lamps of the class the new concern will make. The large acquaintance and experience of these two gentlemen is a safe guarantee that they will prosper, and their friends wish them every success. The new firm is ready for business at Room 714, Havemeyer Building, New York.

ADJUSTABLE POWER PRESS.

The power press shown in the accompanying illustration is extensively used in the metal trades and is adapted to all kinds of cutting, forming and stamping for electrical work, especially armature disks.

These machines possess a number of valuable features, which, combined with their strength, durability and convenience, make them a very desirable machine to have in the workshop. They are readily adjustable to either the



JONES' POWER PRESS.

upright or inclined position by means of small rollers in the frame.

An automatic knock-out attachment for combination disks is provided with the four large-size machines—there being six sizes made. One set screw provides adjustment for different lengths of work.

All these presses are provided with an improved clutch which responds to the treadle almost instantly. The shaft can be turned to bring the slide to any point of the stroke for setting disks while the wheel is in motion, it being impossible to start the press by an accidental pressure upon the treadle.

These machines are made by W. E. Jones, 14 and 16

Water street, Brooklyn, N. Y. Mr. Jones manufactures a large variety of machines of this class, and does a large business in the electrical trade.

MONTREAL NOTES.

The Montreal Electric Co. has lately installed in the rolling mills of Peck, Benny Co., Siemens apparatus for heating strip iron used in the manufacture of horse-shoe nails. The primary current is 1,040-volts alternating, and is transformed down to 15 volts, 500 amperes. This current is used in bringing the iron to a white heat.

A curious accident occurred on Craig street a few days ago. The fuse on a trolley car was blown just as a load of hay was passing the car. The hay took fire, but as the mishap occurred near a fire engine station the fire "laddies" turned out promptly and extinguished the flames.

C. F. Beauchemin, of the Merchants' Telephone Co. of this city, lately visited Quebec, with a view to forming another opposition telephone company there.

L. M. Pinolet, late secretary of the Montreal Electric Club, recently accepted a position in the laboratory of the Moore Electric Co., Newark, N. J., where he will hereafter be located.

The Montreal Electric Co. has installed at the Canada Pipe Foundry Company's Works, two Crocker-Wheeler dynamos of 150 lights each. The installation includes six "Ward" arc lamps.

The Crompton-Howell Storage Battery Co., of London, England, through its agent, John Forman, of this city, is installing a booster in the Royal Victoria Hospital for the purpose of charging up the storage battery plant.

E. W. S.

TEXAS STREET RAILWAY ASSOCIATION.

This association, on January 23 last, held its second annual meeting at Dallas, Texas. Interesting and practical discussions were had. Guard wires were generally condemned, as offering little protection to wires and increasing the danger to pedestrians and horses. The question of insurance was very thoroughly discussed and it was the unanimous opinion of the members that the car houses and power houses should be maintained separately in order to get low rates on cars.

TWO INTERESTING LECTURES.

The Franklin Electrical Society will hold a meeting at its club rooms, 239–241 E. 57th street, New York, at 8 o'clock, P. M., Saturday, March 23. Two experimental lectures will be given; the first on "The Telephone, How it Works," by W. W. Ker, and the second on "Electrical Measurements and Tests," by Newton Harrison, E. E. All interested are cordially invited. The lectures will be both practical and interesting.

NEW QUARTERS.—The Cutter Electrical and Mfg. Co. of Philadelphia, Pa., has moved its quarters to 1112 Sansom street. This change was necessitated by the company's increasing business. This happy condition of affairs has been brought about by the company's fixed determination, followed by persistent effort to give its patrons the highest possible grade of electrical work, and the appreciation and liberal patronage with which it has been favored. We are glad to note that the company is so prosperous.

The Macon Consolidated Railway Company, Macon, Ga., proposes to extend its lines.

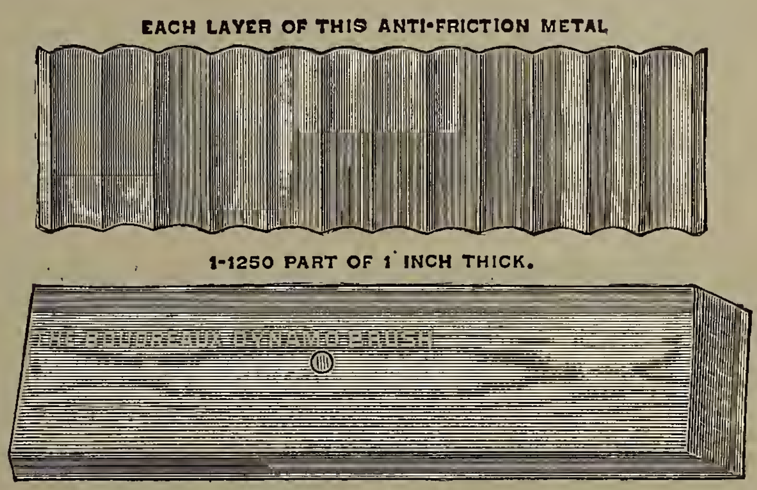
THE BOUDREAUX DYNAMO BRUSH.

Mr. Hugo Benedix, general manager of the Boudreaux Dynamo Brush Company, has just opened offices at 423 Postal Telegraph Building, New York.

The Boudreaux brushes are made of layers of special anti-friction metal, each layer being $\frac{1}{1250}$ of an inch in thickness. The complete brush is made up of these layers, wound or folded according to the machine on which it is to be used. For instance, some of the Westinghouse dynamos require an extra elastic brush, which is produced by folding the layers, one on top of the other, and then submitted to hydraulic pressure to make the brush compact and smooth. The wound brush is desirable for United States, Edison and Brush machines, as these do not require brushes with so great a degree of elasticity.

The conductive power of the new brush is said to be twice as high as that of any gauze or woven brush made, hence the economy in using a smaller sized brush. The brush, being very soft, offers practically no electrical resistance, and needs slight contact with the commutator. It runs smooth, without sparking, and does not cut the commutator.

All brushes are made seven inches long, in widths varying from $\frac{5}{8}$ of an inch to 3 inches, and in thickness from



BOUDREAUX DYNAMO BRUSH.

$\frac{1}{16}$ to $\frac{1}{2}$ inch. All special sizes are made to order.

The company has many excellent testimonials from users of this brush, and they all speak very highly of the goods. The absence of wear and tear on the commutator is an advantage especially emphasized in these testimonials.

LEGAL.

On March 15 Judge Lacombe dissolved the injunction obtained on July 21, 1893, by the Edison Electric Light Company, prohibiting the United States Electric Lighting Company from using a certain improvement on electric lamps, on which a Canadian patent was taken out by T. A. Edison on November 17, 1879. This patent had already expired in Canada, but the injunction was granted on the old contention, respecting the status of the American patent on the same invention. The dissolution of the injunction was based on the recent decision of the United States Supreme Court in the Bate Refrigerator case.

BERGMANN AND KNIGHT ARC LAMPS.

An arrangement has been made between the General Incandescent Arc Lamp Company, S. Bergmann, president, and Robert B. Corey, under which the company will manufacture the entire line of Knight arc lamps. Mr. Corey will be the sole selling agent for the Bergmann and Knight lamps, together with a line of carbons for alternating and direct currents.

New Corporations.

Murphysboro Street Railway Co., Murphysboro, Ill., by Thos. M. Logan, A. B. Winton and S. W. Ward. Capital stock, $11,000.

Joplin & Galena Electric Railway Co., Webb City, Mo. Capital stock, $120,000.

The Hampton Telephone Co., Hampton, Va., by W. E. Lawson, president; M. C. Armstrong, vice-president, H. W. Saunders, secretary, and Jac. Heffelfinger, treasurer.

A telephone company has been organized in Augusta, Ga., by J. H. Jackson and Louis Robert.

The Canajoharie Electric Light and Power Co., Canajoharie, N. Y., by W. J. Arkell and Bartlett Arkell of Canajoharie, and Austin L. McCrae, of Gouverneur. Capital stock, $25 000.

The City Street Railway Co., Savannah, Ill., by W. W. Cargill, Jas. S. Canterbury, Edwin B. Magill and A. D. Appleby. Capital stock, $25,000.

The Milan, Birmingham and Elyria Electric Railway Co., Birmingham, Ohio, by O. C. C. Tillinghast, J. S. King, C. S. Sprague, R. M. Lockwood. Capital stock, $100,000.

Possible Contracts.

The Mayor of Auburn, N. Y., can give information regarding a scheme to build an electric road from Port Byron to Skaneateles.

An electric road will probably be constructed from Cohoes, N. Y., to Dunsbach's Ferry. Urban Weldon, of Cohoes, is interested.

Address Alex. Preston, Baltimore, Md., regarding electrical supplies for fire-alarm and police-telegraph system.

The new electric road in Mohawk, N. Y., has purchased a lot on which to erect a power house.

New machinery is to be installed for the electric light plant at Water Valley, Miss. The Mayor can give further information.

Wm. E. Ragsdale, 106 Oak street, Chattanooga, Tenn., has received the contract for the installation of an electric light plant in the Cloudland Hotel, Roan Mountain, N. C.

Electric railway equipment is required by O. F. Drake, Austin, Tex.

The Staten Island Terminal Electric Railroad Co. has made application to the Board of Trustees of New Brighton, Staten Island, for permission to construct an electric road in that place. Jos. F. O'Grady, clerk, can give further information.

The Recorder of Jacksonville, Fla., will advertise for bids for 50,000 half-inch electric light carbons.

C. D. Vail, proprietor of the Hotel Clifton, Good Ground, L. I., proposes to erect a new engine house and will need a dynamo.

The Staten Island Midland Railroad Co., Stapleton, L. I., proposes to change its motive power from horses to electricity.

It is reported that an electric railroad is to be built from Buffalo to Hamburg, N. Y., by the Hamburg Electric Railway Co. Among those interested are James E. Curtiss, L. L Long, R. E. Hanta, Wm. Elwood, Thos. L Bunting, H. S. Spencer and others.

It is proposed to establish an electric light plant in Port Ewen, N. Y. Johnson Munson of that place is at the head of the enterprise.

There is talk of establishing a municipal electric light plant in Norwich, Conn. The Mayor can give further information.

A municipal electric light plant will probably be erected in Danbury, Conn. Mayor Andrews can give further particulars.

Plans are to be invited for building an electric light plant in Knoxville, Tenn. The Light Committee of the city council has the matter in charge.

The bids recently opened in Milwaukee, Wis., for an electric light plant in the new City Hall, were all rejected on account of being too high. Bids will be readvertised.

E. W. Henck, of Longwood, Fla., has obtained a franchise to establish an electric light plant in Tampa, Fla.

M. H. Crump, secretary of the Commercial Club, Bowling Green, Ky., can give information regarding the proposed power plant for the electric railway in that place. The machinery will include a 150-h. p. boiler and engine, and an 80-k. w. generator.

S. C. Hurt & Son, of Lynchburg, Va, will make extensive improvements in the gas and electric light plant at Bristol, Tenn., which they have recently purchased.

A power station for the electric railway at Ocean View, Va., is to be built by Chas. H. Barrett and F. H. Treat, of Philadelphia.

Baldwin & Pennington, Baltimore, Md., are the architects of the proposed depot of the Baltimore Belt Railroad.

The Y. M. C. A. of Chapel Hill, N. C., will erect a new building, which will be lighted by electricity, and have all the other electrical improvements.

A large auditorium is to be built in Dallas, Tex. T. F. McEnnis, of that place, is the prime mover in the enterprise.

A new union depot is to be built in St. Joseph, Mo. E. J. Eckle, of that place, has prepared the plans.

The Charlotte and Mecklenburg Railroad Company has been organized in Charlotte, N. C., and will build an electric line in that city.

Telephone Notes.

The Silver Telephone Company, Argentine, Kansas, has been organized by G. W. Gully, G. W. Simmons, Wm. McGeorge, Edward Blundon, M. B. M. White and G. A. Taylor.

A new telephone company is being organized in Forsyth, Ga.

A telephone franchise has been granted to Mr. William West, Milledgeville, Ga.

A telephone company is being organized in Monroe, La., by W. R. Reily.

A telephone system is to be installed in the Tennessee woollen mills, McMinnville, Tenn.

A telephone company has been organized in Paragould, Ark., by E. S. Bray, T. B. Kitchens and Fred Hoffman.

A telephone company has been organized in Easton, Md., by M. M. Higgins, A. G. Pascault, J. S. Griffith and J. F. Bateman.

The Salmon City Electric Light, Power and Water Co., Salmon City, Idaho, proposes to erect a telephone line to Red Rock.

The Hudson River Telephone Co. is to extend its lines from Hoosick Falls, N. Y., to the State line and connect there with the lines of New England Telephone Co.

Principles of Dynamo Design.—Owing to the illness of Mr. Harrison, that gentleman was unable to prepare the manuscript of his article for this week's issue. The article will be continued in our next issue, however.

Financial.

The Executive Committee of the Western Union Telegraph Company has recommended the declaration of a quarterly dividend of 1¼ per cent.

The Westinghouse Electric and Manufacturing Company has declared a quarterly dividend of 1¾ per cent. on its preferred stock, payable April 1.

The Edison Electric Illuminating Company of New York reports gross earnings for February of $143 588, an increase of $19,529 as compared with the same month of last year, and net $74,909, an increase of $1 923.

The American Telephone and Telegraph Company of New York city, on March 12, filed with the Secretary of State, Albany, N. Y., a certificate of increase of its capital stock of $12,000,000. The amount of capital actually paid in is $7,500,000.

The Edison Electric Illuminating Company of Brooklyn reports gross earnings for February of $42,412, an increase of $9,546 as compared with the same month of last year, and net $17,961. Interest on bonds, $2,100, leaving a balance for dividends of $17,281, an increase of $1,714.

New York Notes.

Office of the Electrical Age,
World Building, New York,
March 18, 1895.

The Bell Electric Co., of New York, has just opened offices at 26 and 28 Church street. The company will carry a full line of its barbers' specialties. It will make novelties worth spending the time to call and see.

Mr. J. P. Hall, electrical engineer and contractor, has moved his offices to Rooms 328 and 329 of the Central Building, 143 Liberty street. He was formerly located on the second floor of the same building.

Messrs. J. Jones & Son, 67 Cortlandt street, New York, are moving their factory from New York to more commodious quarters at 114 Front street, Brooklyn, where they will manufacture a general line of arc and incandescent electric light goods. They will continue their old business in "Early Risers," alarm clocks, battery supplies, etc. Zincs and coppers will be among their principal specialties. The firm believes they will be the leading producers in the country of this line of goods.

Mr. E. V. Baillard, the manufacturing electrical engineer, 106 Liberty street, is moving into larger quarters on the third floor of the same building. Mr. Baillard's new quarters are much larger and in every way superior to his old, and he will be better enabled to keep up with his rapidly increasing business, which had outgrown the old quarters. He has a large space, about 75 feet long by 25 wide, with an abundance of power. His new shop is well equipped with power and hand machinery. There are six lathes, two drill presses, a shaper, a miller and many other smaller machines. He will install an alternating-current dynamo and a direct-current dynamo, both of which he will use for experimental work. He will use the Edison street current.

The Electrical Maintenance Company, of 50 Broadway, is the pioneer in a new industry which offers an excellent field for enterprise. The object of the company is to inspect and to maintain electrical plants at their highest efficiency. The company stands in the same relation to electrical plants that the doctor does to human kind. It will administer the proper remedies and make the ailing machinery well again. It proposes to doctor an electric plant by the year at a price greatly below what would be paid on the average to the repair shops. The company will be prepared for night calls as well as for day service, and will give prompt attention to both. The officers of the new company are: President, Edw. R. Johnes; Treasurer, Geo. H. Cook; Secretary, Robt. L. Johnson; General Manager, Jas. J. McKenna. W. T. H.

Trade Notes.

Mr. Addison Conkling, of 253 Broadway, New York, is the inventor of a mammoth calendar which, no doubt, will find a large demand. There is a sheet for each day, and the characters are large enough to be seen a block away.

The Cross Engine Company, of New York, has just issued its catalogue of the Cross engine for high speeds. This engine is of entirely new design, and combines maxima of strength, speed and simplicity, and minima of weight, wear and waste.

We have received from J. W. Godfrey, manager of sales of the India-Rubber and Gutta-Percha Insulating Company, a neat little pocket memorandum book, with an illustrated price list of Habirshaw wires and cables. Mr. Godfrey's office is at 15 Cortlandt street, New York.

Wallace & Sons, 29 Chambers street, New York, have just issued their 1895 catalogue of sheet brass, sheet copper, tubing and wire for all electrical purposes, and the large variety of other metal goods manufactured by this house. The catalogue is well illustrated, and at the back part there are several valuable tables pertaining to wires, etc.

The Du'Pey Specialty Company, room 12, World building, New York, manufactures a lubricant that is destined to make its mark in the electrical trade. The compound has been practically tested for six years, and it has given remarkable results in the way of durability and reduction of friction. The manufacturers claim that it has a durability ten times greater than that of any oil, and produces a reduction of at least 20 per cent. of friction of the average bearings of a factory operated by steam. It is being used on dynamos and motors with excellent results.

The Non-Condensing Corrugated Roofing Company, 143 Liberty street, New York, is developing a satisfactory business in the electrical trade with its non-condensing, fire proof and rust-proof corrugated steel roofing. This roofing has lately been put upon the market. The fire-proof lining is firmly secured to the steel sheets, making a perfect union therewith. This roofing affords a reliable protection and preventive against sweating, and is especially adapted for power-houses, car-works, electric light stations; in fact, for buildings of every description. It is spoken of very highly by electrical engineers and contractors.

WOVEN WIRE BRUSHES.

The Belknap Motor Co., of Portland, Maine, are the patentees and manufacturers of the best woven wire commutator brush on the market.

ELECTRICAL and STREET RAILWAY PATENTS

Issued March 12, 1895.

535,345. Closed-Conduit Electric Railway. Edward M. Bentley, Boston, Mass. Original application filed Dec. 11, 1885, Serial No. 185,411. Divided and this application filed Feb. 25, 1891.

535,352. Motor-Truck. John A. Brill, Philadelphia, Pa. Filed Jan. 3, 1894.

535,363. Electric Heating Apparatus. Mark W. Dewey, Syracuse, N. Y., assignor to the Dewey Electric Heating Company, same place. Filed March 12, 1894.

535,370. Electric Clock Striking Mechanism. Fred L. Gregory, Chicago, Ill. Filed Jan. 30, 1894.

535,388. Fender for Street-Railway Cars. George H. Modemann, New York, N. Y. Filed Dec. 14, 1893.

535,398. Conduit Electric Railway. Daniel O'Flaherty, Kansas City, Mo., assignor to Ella A. O'Flaherty, same place. Filed Mar. 31, 1894.

535,436. Life-Guard for Cars. Albert E. Wyatt, Jersey City, N. J. Filed Dec. 17, 1894.

535,443. Electric-Lighting System. Joseph I. Conklin, Brooklyn, N. Y. Filed July 30, 1894.

535,479. Sanding Device for Street-Cars. Fredrick F. Baumann and Jacob Weinz, Boston, Mass.; said Baumann assignor of one-half of his right to Louis Weiss and Julius Weiss, same place. Filed Jan. 5, 1894.

535,484. Electric Burglar-Alarm and House-Call. Henry L. Carpenter, Minneapolis, Minn. Filed Apr. 16, 1894. 1894.

535,488. Thermo-Electric Generator. Harry B. Cox, Hartford, Conn. Filed Mar. 8, 1893. Renewed Aug. 14, 1894.

535,489. Thermo-Electric Generator. Harry B. Cox, Hartford, Conn. Filed Mar. 8, 1893. Renewed Aug. 14, 1894.

535,490. Thermo-Electric Generator. Harry B. Cox, Hartford, Conn. Filed Mar. 8, 1893. Renewed Aug. 14, 1894.

535,491. Indicating System for Thermo-Electric Generators. Harry B. Cox, Hartford, Conn. Filed Jan. 31, 1894. Renewed Feb. 13, 1895.

535,511. Electrical Controller. Elmer A. Sperry, Cleveland, Ohio, assignor to the Sperry Electric Railroad Company, of Ohio. Filed Nov. 11, 1893.

535,524. Clamp for Trolley-Wires. Warren M. Annable, Grand Rapids, Mich., assignor of one-half to the Butterworth & Lowe, of Michigan. Filed Nov. 23, 1894.

535,530. Starting Alternating Motor. Ossian Chytræus, Pittsfield, Mass. Filed Dec. 4, 1894.

535,533. Electric Switch. Mark W. Dewey, Syracuse, N. Y. Filed Jan. 11, 1895.

535,540. Automatic Telephone-Switch. Newman H. Holland, Montreal, Canada Filed Aug. 10, 1894.

535,541. Method of Constructing Secondary Batteries. Arthur Hough, San Francisco, Cal. Original application filed Sept. 14, 1893. Divided and this application filed Dec. 14, 1893.

535,579. Armature-Conductor for Dynamo Electric Machines. Henry Geisenhöner, Schenectady and Christian Sandman, Niskayuna, N. Y. Filed Jan. 15, 1895.

535,589. Electric-Arc Lamp. John C. Knight, New York, N. Y. Filed Mar. 2, 1894.

535,615. Telephone. William W. Dean, St. Louis, Mo., assignor to the Bell Telephone Company of Missouri, same place. Filed Sept. 24, 1894.

535,688. Car-Fender. Herbert B. Ewbank, Jr., Baltimore, Md., assignor of one-half to Herbert Bryant Ewbank, same place. Filed Jan. 4, 1895.

535,692. Carbon-Holder for Arc-Lights. Adam W. France, Philadelphia, Pa., assignor of one-half to Arthur H. Jones, same place. Filed Nov. 10, 1894.

535,703. Electric Cableway. Richard Lamb, New York. N. Y. Filed July 19, 1894.

535,733. Car-Fender. Louis L. Seaman, New York, N.Y., assignor to the Darrach Car-Fender Company at Newark, N. J. Filed Jan. 3, 1895.

535,741. Car-Fender. James C. Sneden, Philadelphia, Pa. Filed Jan. 12, 1895.

535,745. Telephone Exchange Apparatus. Charles Felix Gaston Marie Bigot de la Touanne, Paris, France. Filed Dec. 30, 1893.

535,763. Street-Car Fender. Stephen S. Kimball, Montreal, Canada. Filed August 4, 1894.

535,776. Car-Fender. Sanford H. Shaw, Philadelphia, Pa. Filed Oct. 26, 1894.

535,796. Construction and Regulation of Dynamo-Electric Machines. Charles D. Haskins, Brooklyn, N. Y., assignor to the Western Electric Company, Chicago, Ill. Filed Aug. 6, 1894.

535,797. Regulation of Dynamo-Electric Machines. Charles D. Haskins, Brooklyn, N. Y., assignor to the Western Electric Company, Chicago, Ill. Filed Aug. 6. 1894.

535,806. Automatic Central Telephone-Switch Apparatus. Franz Nissl, Vienna, Austria-Hungary. Filed Feb. 17, 1894. Patented in Belgium Oct. 17, 1893, No. 106,776.

11,478. Electrical Fixture. Luther Stieringer, New York, N. Y., assignor, by direct and mesne assignments, to George Maitland, Detroit, Mich. Filed Dec. 21, 1894. No. 259,235, dated June 6, 1882.

ELECTRICAL AGE

VOL. XV., No. 13. NEW YORK, MARCH 30, 1895. WHOLE No. 411

ESTABLISHED 1883.

Entered at New York P. O. as second-class matter, January 18, 1891.

THE ELECTRICAL AGE PUBLISHING CO., PUBLISHER

TERMS OF SUBSCRIPTION:

One Copy, one year,	$3.00
One Copy, six months,	1.50
Great Britain and other Countries,	4.00

Cable Address (all Cables,) "Electage," New York.

W. T. HUNT, President F. N. BASSETT, Vice-President.
T. R. TALTAVALL, Secretary and Editor.
NEWTON HARRISON, E. E., Scientific Editor.

ADDRESS ALL COMMUNICATIONS TO
THE ELECTRICAL AGE PUBLISHING COMPANY,
FIRST FLOOR, WORLD BUILDING.
NEW YORK.

NEW YORK, MARCH 30, 1895.

CONTENTS.

THE CONSOLIDATION OF GENERAL ELECTRIC AND WESTINGHOUSE INTERESTS.

For the past few days rumors regarding the consolidation of the General Electric Company and the Westinghouse Electric and Manufacturing Company have been plenty, each with an aspect that could not fail to suit some purpose. Wall street was interested in one report that the two concerns had entered into an arrangement to pool their patents; and another story was to the effect that the two companies had actually consolidated under the charter of the North American Company. It is impossible to obtain a verification or denial of any one of these reports at the present time.

We have it from a source, however, which we regard as authoritative, that a combination was practically effected on Monday last. The combination, as we are informed, is not a physical one, but rather an agreement between the two companies to carry on business harmoniously for their mutual good. The arrangement has for its object the restoration of reasonable prices for manufactures by stopping the strong competition between the two concerns. This competition has for years been cutting down prices so that in many cases business was done at a loss, and many worthy concerns have been crowded to the wall, in not being able to maintain a standing against such adverse conditions. We think the effect of the consolidation, amalgamation, agreement, or whatever it is, will be salutary to the trade in general. It should restore prices to a degree where a reasonable profit can be made, and in other ways stimulate trade. The smaller, independent dealer will then have a better chance to do business and in other ways the trade should be benefitted. In the electric-railway field should improvement be the sharpest. Many worthy systems will likely come to the front in a fair and square contest for the business to be had. Therefore, from our point of view, the burying of the hatchet between the two giants augurs well for the trade in general.

STEAM ROADS HARD PUSHED BY TROLLEY LINES.

At a hearing on March 19, before the Railroad Committee of the Connecticut legislature, Hartford, representatives of the New York, New Haven and Hartford, and the York and New England Railroad Companies argued against the granting of charters to electric railroads paralleling existing steam roads. They presented in support of their arguments statistics showing the depreciation in passenger receipts during the past three months, which is traced directly to the competition of electric roads where they parallel the steam lines between stations. The statistics are of extreme interest, and are as follows:

Between Norfolk and Rowayton, a loss of 50 per cent. of the entire business. Between Bridgeport and Southport, a loss of 80 per cent. of all business. Between Bridgeport and Stratford, $35 per day. Between New Haven and Woodmont station 50 per cent. of all business. Between New Haven and West Haven, 70 per cent. of all business. Between Wallingford and Meriden, 30 per cent. of all business. Between New Haven and Lake Saltonstall, 45 per cent. of all business. Between Meriden and Yalesville, about 90 per cent. of all business Between Southington and Plantville, practically all the business. Between Unionville and Hartford, 40 per cent. of all business. Between Hartford and Glastonbury, 30 per cent. of all business. Between Derby, Ansonia, and Birmingham, 90 per cent. of all business. Between Ansonia and Derby, $1,500 a year. Between Naugatuck and Waterbury, $300 a month. Between Union City and Waterbury, $170 per month. Between Waterbury and Naugatuck, 90 per cent. of all business. Between Winnipank and South Norwalk, 50 per cent. of all business. Between South Norwalk and Winnipank, 90 per cent. of all business. Between Norwalk and Royalton, 50 per cent. of all business. Between Danbury and Bethel, 75 per cent. of all business.

ELECTRIC LIGHT-SHIP AT SANDY HOOK.

The Lighthouse Department of the United States recently placed off Sandy Hook a light-ship that is the first of its kind ever put into service. Its lights are electric, and in other respects it is said to be probably the finest and best equipped light-ship afloat.

Through the courtesy of Captain W. S. Schley, U. S. N., Inspector Third Lighthouse District, we are enabled to give complete data of the electrical equipment of this ship.

The power equipment consists of two horizontal high speed Harrisburg "Ideal" engines, with automatic cut-off governor, each capable of developing eight H. P. at normal speed, with 70 pounds of steam, cutting off at one-quarter stroke.

Each engine drives a Thomson-Houston compound-wound, direct-current dynamo, of 60 amperes capacity at 110 volts at machine terminals. The dynamos are automatic in their regulation, so that three-fourths of the total number of lamps can be extinguished with safety without material change in speed. The dynamos are so located that with Evans friction cones either engine may be used to run either or both dynamos. The commercial efficiency of each dynamo is, according to the specifications, at least 80 per cent. The dynamos were supplied by the General Electric Company and the whole plant was installed by them.

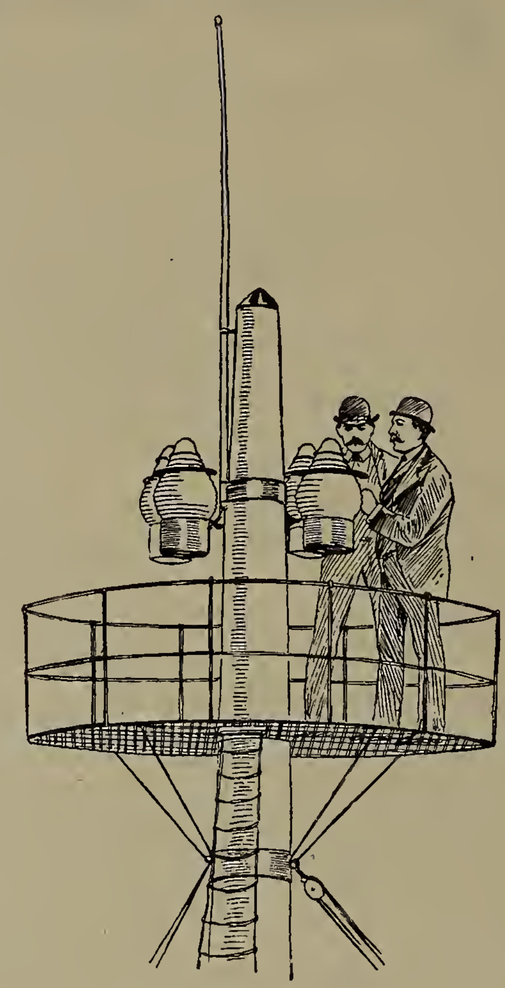
The engines and dynamos cover a floor space of nine feet by eight feet.

The switchboard is arranged for four independent circuits, with conuections for testing instruments in each circuit, and switches for throwing in and out either dynamo. Each circuit is provided with proper fuses. The voltmeter and ammeter are of the Ayrton and Perry spring pattern, of the pr per capacity for the plant. A device is provided for alternately opening and closing at regular intervals the circuits to the lamps at the mast-head. This is known as the flashing device.

Each mast-head is provided with four lens lanterns with totally-reflecting prisms, and each lantern is lighted by one 100 candle-power Edison incandescent lamp. There are four such lamps on each mast-head.

The lamps are of the keyless socket type with spiral sides. After the wires were placed in the grooves the latter were covered with a batten flush with the mast, securely fastened by brass screws.

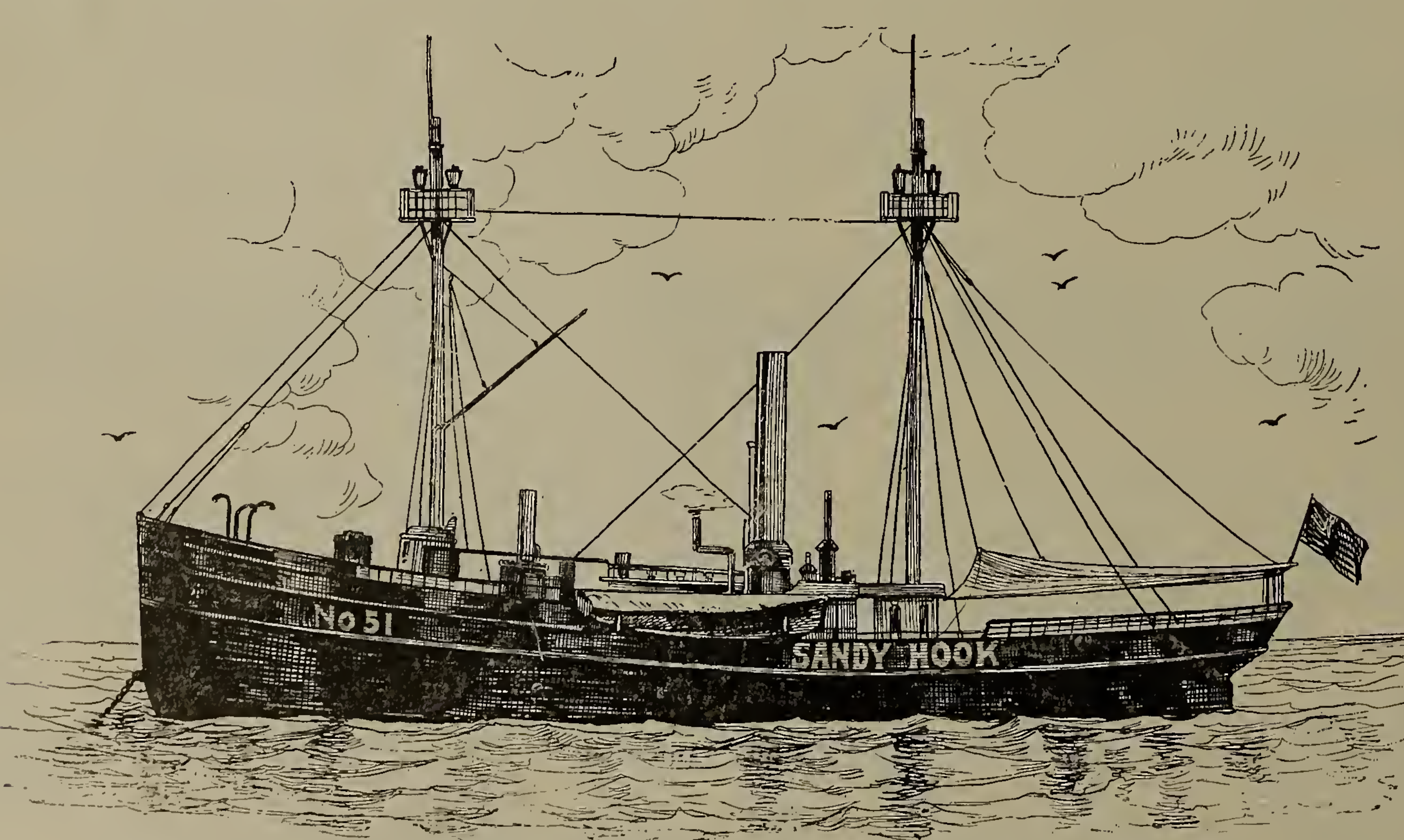
The conductors are of sufficient size to carry twice the normal current withont undue heating. The drop in potential between the dynamo and the extreme end of any circuit is less than five per cent.



MASTHEAD LANTERN.

The other wiring on the ship is enclosed in wooden mouldings 15 inches apart.

No insulating material that is injuriously affected by moisture, or temperature of 200° F., is used at any point of the installation.



ELECTRIC LIGHT-SHIP OFF SANDY HOOK, NEW YORK HARBOR.

filaments. Each lamp has a guaranteed life of 600 hours.

The vessel is wired on the two-wire system with No. 14 Grimshaw white-core wire, 500 feet of it being required for the purpose. The wires to the mast-heads are lead covered, and placed in two grooves cut in the mast on opposite

The position of the Sandy Hook light ship is at the entrance to Gedney's Channel, New York Bay, seven miles east of Sandy Hook. Besides being an important mark for the guidance of mariners, it is used by the fast liners as the basis of their calculations in timing their trips across

the ocean. It is also a famous marking point in yacht races, and in its exposed position Old Neptune makes it jump around in a very lively fashion.

Our illustrations, which were kindly loaned us by the New York *World*, give excellent views of the light-ship, and one of the mast-head equipments. The method of distributing the illumination is clearly shown in the latter illustration.

A METHOD OF PREVENTING ARMATURE REACTION.*

BY HARRIS J. RYAN AND MILTON E. THOMPSON.

While making a thorough consideration of the subject of armature reaction some time since, one of the authors of this paper devised a means of entirely preventing armature

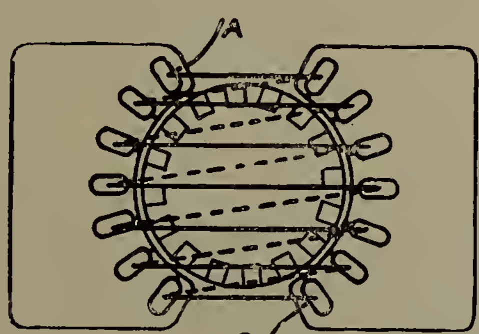


FIG. I.

reaction and resulting field distortion. On looking up the literature of the subject we found, mainly through the patent office records, that there were several workers in the field at a comparatively early date, viz.: Professor Elihu Thomson, Messrs. Andrews and Spencer, Mather, Forbes, and possibly one or two others. The specifications given by Andrews and Spencer indicate clearly the technical side of this method for preventing armature reactions, while our part appears in the development of a plan for the practical application of the scheme technically outlined by them in 1886. This method consists in general in surrounding the armature with a stationary winding exactly similar in its magnetic effects to the armature winding, but directly opposed to it, and thus completely balancing all armature reaction. Fig. 1 is a diagram that shows the manner in which the coils are applied. Holes are provided immediately back of the pole surfaces, and through these holes are wound conductors which are placed in series with the armature. *The number of ampere-turns of the balancing coils crossing each pole face is equal to, and opposite in direction to the number of ampere-turns on the corresponding part of the armature.*

A small bi-polar machine of about 2½ kilowatts capacity was designed, constructed and tested during the spring and summer of 1891, and the results obtained were very encouraging, demonstrating beyond doubt the correctness of one's understanding of the principles involved Since that time some half dozen or more multipolar machines of various sizes have been designed and constructed. All employ these balancing coils with various modifications of design.

While the "balancing coils," as may have been seen from the foregoing results, entirely prevent field distortion and shifting of the neutral point, there is still something lacking for ideal commutation. In a constant potential dynamo, the following are the conditions for perfect and sparkless commutation. When a coil is short-circuited as it passes under a brush, the current in the coil must fall to zero, reverse, and rise exactly to the original value in the opposite direction at the instant the short-circuited coil is opened by the passage of the tip of the brush from the commutator bar. To bring about this reversal properly, the short-circuited coil must move during short-circuit through a field whose strength is proportional to the armature current. In other words, the short-circuited coil should move in a neutral field when the machine is unloaded, and should move in a field of considerable strength when fully loaded. The field strength required for sparkless commutation under any particular load depends first on the resistance of the short-circuited coil; second, the self-induction of the short-circuited coil; and third, the duration of the short-circuit which in turn depends on the width of brush and speed of the dynamo. Preferably the short-circuited coil should move in a uniformly distributed field. It is evident from this consideration that we do not get the conditions for perfectly sparkless commutation even where armature reaction is prevented if we attempt to commutate under pole corner. It is also evident that if armature reaction and field distortion *are* not prevented, we get just the opposite effect on our commutation from what we would wish—that is, our commutation field grows weaker as the current increases, instead of growing stronger as it should. From this we may set it down as a settled fact, that no dynamo of any considerable voltage and range of capacity which commutates under the leading pole corner and is not provided with some special spark-preventing device or arrangement for preventing field distortion can be worked from no load to full load without sparking or without shifting the brushes. During their experimental work on balancing armature reaction, the writers devoted considerable time to the problem of sparkless commutation, and as a result have devised an improvement to be used in connection with balancing coils by means of which ideal commutation is attained. The device is simple, and accomplishes the desired end perfectly. It consists in bridging across the gap between the pole-pieces, attaching a commutation lug to the centre of this bridge and making this lug the centre of the balancing coil, the latter being provided with a few extra turns. The arrangement is shown in fig. 2, which represents a portion of the field circuit sectioned centrally in the plane of rotation. Referring to the figure, *aa* and *bb* are two field coils wound round the pole-necks C and D; G is the commutation lug which is attached to the middle of the lugs H I, which latter bridge across the gap between the pole-pieces E and F. The balancing coil (not shown) is wound through the holes K, L, M, N, O, P, with the commutation lug G at the centre of the coil. The path for magnetism is indicated by the dotted lines. It will be noticed that a part of the magnetic lines

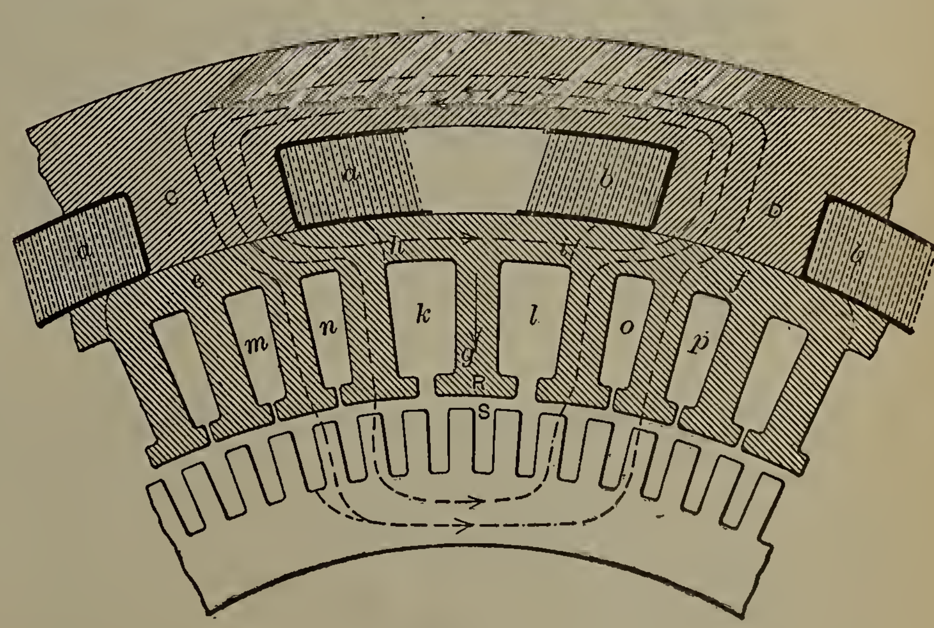


FIG. 2.

are shunted across between the pole-pieces E and F, through the bridge lugs H I, and do not pass through the armature. Now, when there is no current in the armature or balancing coils, it may be easily seen that the fall of magnetic potential from E to F is the same by either the path through the bridge lugs, or through the armature, and that the commutation lug, G, attached to the middle of the bridge lugs, must be at the same magnetic potential as the armature teeth opposite, for the latter are connected to the middle of the armature circuit. Therefore under these conditions, which are practically what we have when the machine is running light, there will be no field between the surfaces R

*Abstract of paper read at the ninety-fifth meeting of the American Institute of Electrical Engineers, New York and Chicago, March 20, 1895.

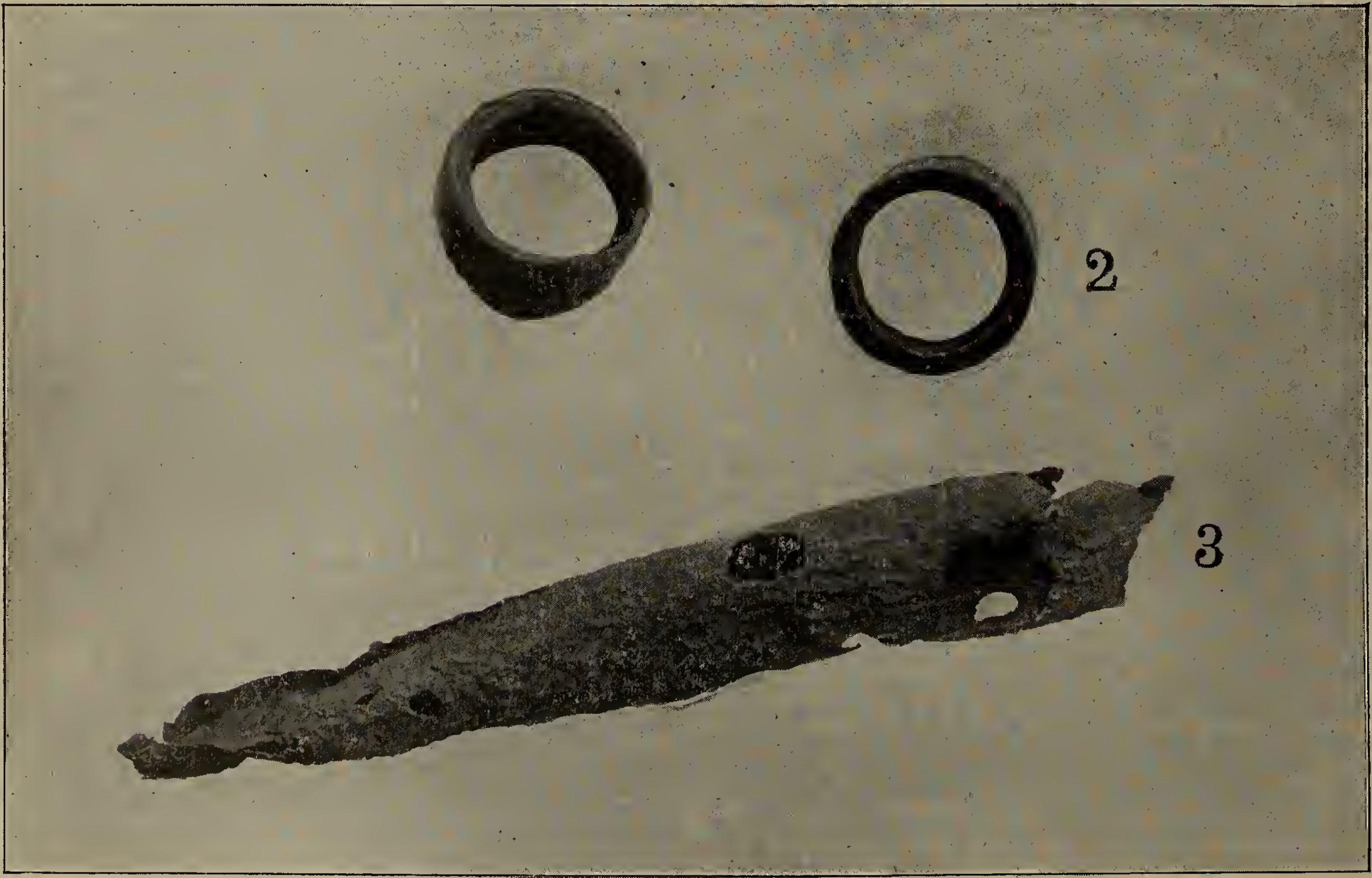
and S of the commutation lug and armature respectively. If, then, our brushes are set so that commutation takes place while the short-circuited coil is passing under the commutation lug, we have the correct conditions for sparkless commutation. When the machine is loaded, the excess of ampere-turns of the balancing coils over ampere-turns of the armature brings a magnetizing force to bear on the lug G in the direction indicated by the arrow. This tends to increase the magnetism through H and diminish it through I, but as H is normally saturated, there will be very little increase in its magnetism. There will, however, be a field established under the commutation lug, by the deflection of the lines from the bridge lug I through the commutation lug and armature, and it is evident that the stronger the current in the balancing coils the stronger will be the field under the commutation lug. We, therefore, again have the correct condition for sparkless commutation when the machine is loaded, provided our balancing coils are so proportioned as to give us a commutation field of proper strength. From this it will be seen that at all times the commutation field is proportional to the current, and that for all loads we have the requisite conditions for sparkless commutation without shifting the brushes.

So much for the theory of this plan, and now comes the important question, "Will it work in practice?" We are able to answer without hesitation that such a machine performs as well in practice as in theory, and that actual tests show absolutely sparkless commutation from no load to 50 per cent. overload with fixed metallic brushes. More than this, practice confirms another theoretical advantage of this improvement which we have not yet touched upon. It will be noticed that the commutation field is obtained by the deflection of lines from bridge lug I, and that the lines so deflected pass through the armature, and consequently are added to the useful magnetic field. We might expect from this, and from the fact that since the brushes are midway between the poles, there are no back ampere-turns, that the machines would compound somewhat without a regular compound winding. This theory was entirely sustained by actual trial. It was found, under test, that by slightly shifting the position of the brushes forward or backward, it was possible to make a few of the armature turns act with, or against the field winding at will, and this without any effect on the sparkless commutation, so long as the brushes were not moved beyond the limits of the commutation field. The result of this is that by simply shifting the brushes, the compounding of the machine may be so changed that it can be adjusted at any point from 10 per cent. drop to 10 per cent. over-compound, and this without interfering with the commutation in any way.

CORROSION OF UNDERGROUND PIPES IN BROOKLYN.

In our issue of February 16th last we gave a summary of the report of the Board of Commissioners of Electrical Subways of Brooklyn, N. Y., for the year ending December 31, 1894. In that article the corrosion of underground pipes by return trolley currents was referred to. The accompanying illustrations taken from the report, tell the story of the destructive work going on underground.

Fig. 1 and 2 show sections of pipe corroded at a screw joint.



FIGS. 1, 2 AND 3.

Fig. 2 shows the normal thickness of the pipe only 1½ inches from the joint. Fig. 1 shows the effect of the current at the joint of another section of the same pipe, which was a water supply pipe of 1⅜ inches outside diameter, laid near Fulton Ferry.

Fig. 3 shows a piece of a copper drip pipe taken from the same locality. This pipe originally had an outside diameter of 1 inch, and was reduced to the condition shown in the illustration in 17 days.

Figs. 4 and 5 represent pieces of lead water-pipe taken from a coal yard in Brooklyn. These pipes were laid in a trench about 3 feet 6 inches deep and enclosed in a 5"x 5" spruce box or trough of 2" stuff coated with coal tar. The box was filled in around the pipe with clean builders' sand.

Fig. 6 shows a piece of an iron service pipe of ¾-inch outside diameter. Pipes located within three feet of the track were reduced to the conditions shown, in about two years.

In this connection it will be of interest to illustrate and describe the method employed by the Brooklyn Commission to form a connection with the water mains in order to make tests for stray currents.

The illustration, Fig. 7, shows the form of the apparatus used. It was made under the direction of M. G. Starrett, chief electrician of the Brooklyn City R. R. Co.

FIGS. 4 AND 5.

The collar is of wrought iron in two parts ⅝ of an inch thick and two inches broad. The two parts are drawn together by ¾-inch bolts with two nuts to each bolt. The collar is previously turned out upon its inner face to ¼ of an inch larger than the diameter of the pipe to which it is to be applied. Midway in one part is formed a lug into which is brazed a No. 00 copper wire.

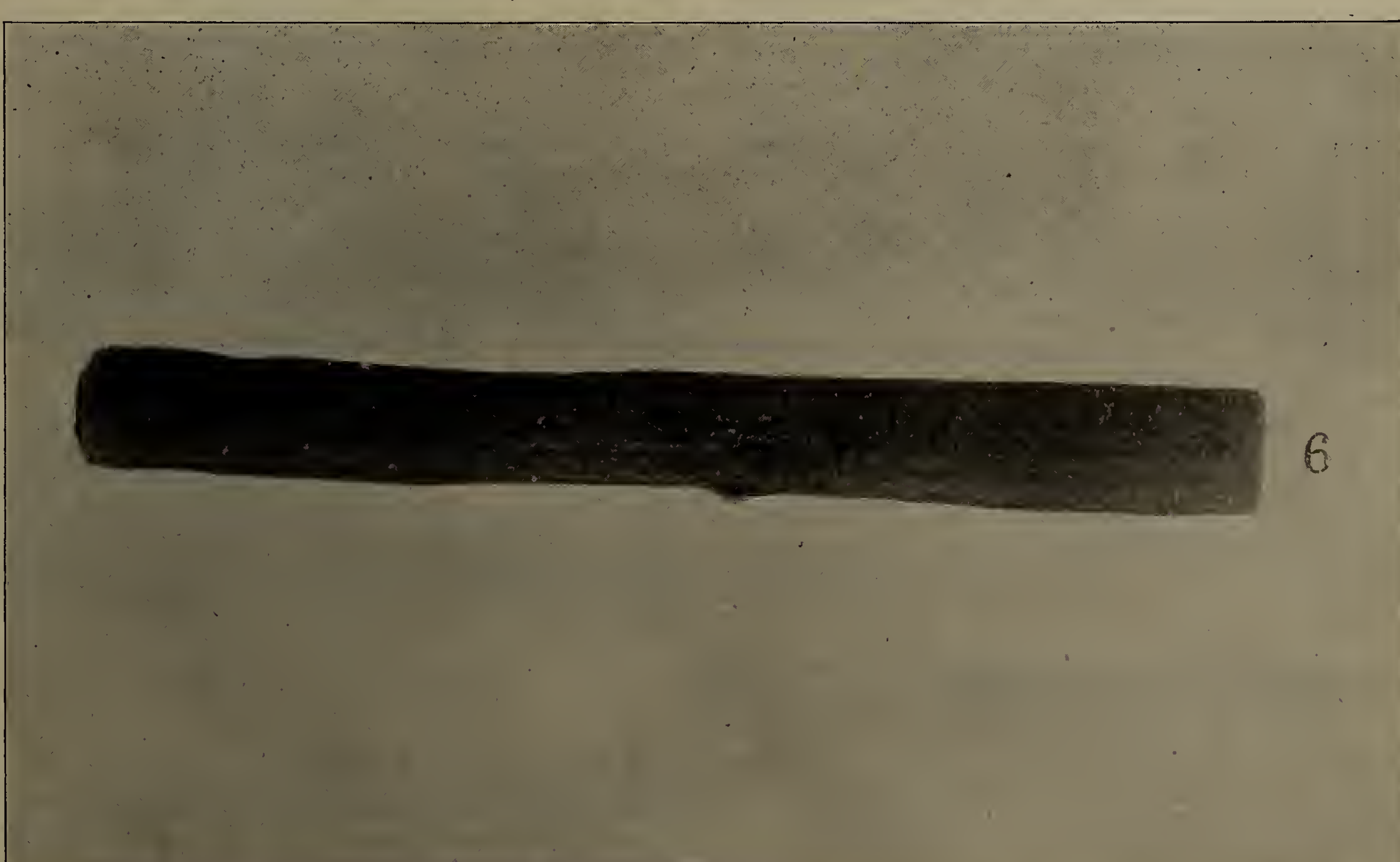


FIG. 6.

In applying the connection the pipe is carefully brightened all around with a file, a strip of bright lead $\frac{5}{32}$ of an inch thick and 2½ inches broad is laid around the pipe and the collar is clamped down by the bolts until the lead gasket is meshed into the inequalities of the pipe. The lines of junction between the collar and lead and pipe are thickly painted over with "P. & B." compound, then completely taped over and again painted with "P. & B." upon the tape, after which the whole is thoroughly packed with good cement.

MAYER DYNAMO AND MOTOR.

The illustration herewith shows the new bi-polar iron-clad machine made by Mr. Maxwell M. Mayer, of New York city.

The magnets, it will be observed, are in a vertical position, and the frame, which is of the best steel, is cast in one piece. These machines have an exceptionally low leakage factor, there being no external magnetism; and the leakage on the inside of the frame being reduced to a mininum.

The armature is of the Siemens drum type, of comparatively large diameter. The core is finely laminated to prevent the generation of eddy currents and hysteresis

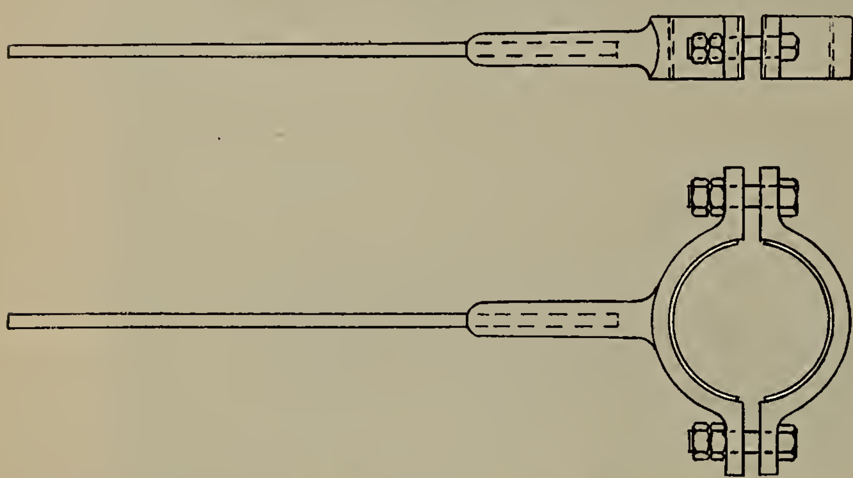


FIG. 7—UNDERGROUND PIPES, BROOKLYN.

losses. The wire is wound in slots milled into the core. The coils are wound in alternate sections connecting a long and short coil, thus effecting a perfect electrical balance in the armature. At the armature head the winding is open to provide ventilation. On account of the high permeability of the magnetic circuit, the small reluctance of the air space and small ohmic loss, the absence of eddy currents, etc., in the armature is very marked, rendering the machine one of high efficiency.

There is no sparking, this result being obtained by having the field much more powerful magnetically at all loads than the armature, thus overpowering the reactions of the latter and preventing the displacement of the neutral line.

The dynamos are shunt wound, this winding preventing reversal of polarity when the machine is used for electroplating.

In the mechanical construction of these machines the details have been very carefully developed, and the material that enters into their make-up and the workmanship applied are of the best available.

The commutator is made of tempered copper, and insulated with mica. Carbon brushes are used on the motors and light dynamos, while on the machines for electroplating gauze brushes are provided.

Mr. Mayer has had along experience in dynamo designing and building, several hundred of his machines, principally platers, being in daily use. The plating machines made by the Zucker and Levett Chemical Company are of his design, and well known for their efficiency. The machine illustrated herewith, however, is of entirely new design

Mr. Mayer has a large and well-equipped factory, and has every facility for turning out these machines in the best manner possible. All the machines are constructed under his personal supervision.

Mr. Mayer's factory is at No. 411 107th street, East river, New York city.

A Valuable Document.—We have received a copy of the report of the New York Railroad Commissioners for 1894. It consists of two volumes. Vol. I. is devoted to decisions and other legal matters bearing on railroad property. Vol. II. contains reports and other railroad statistics.

OBITUARY.

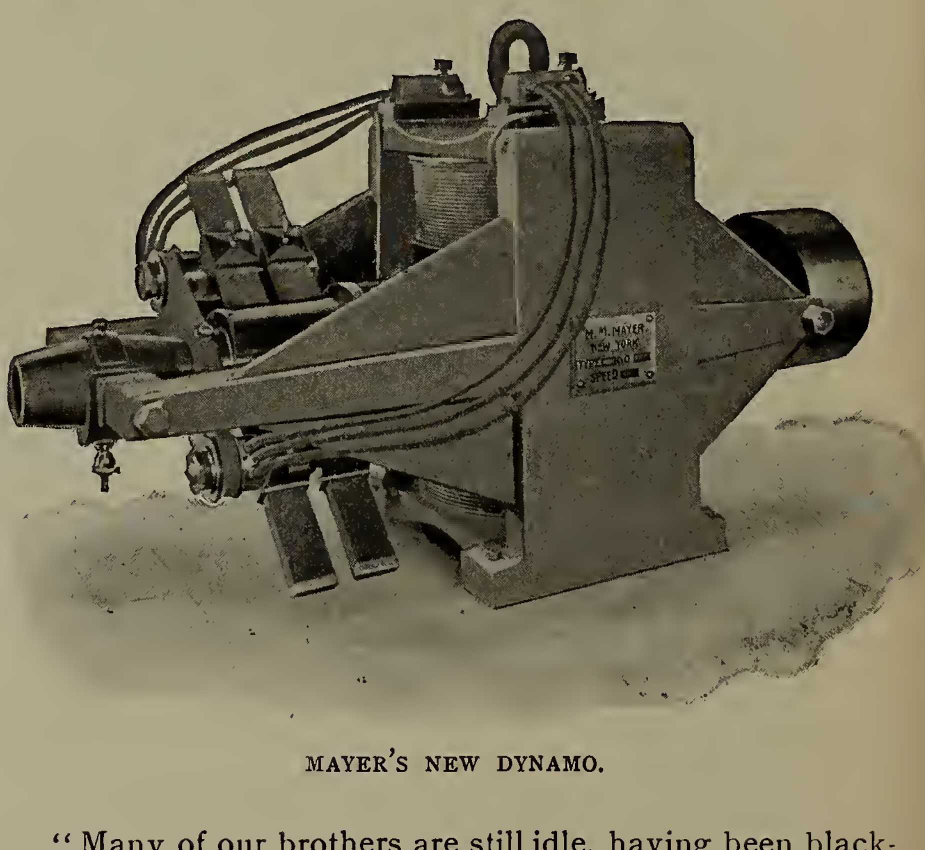
PETER H. VAN DER WEYDE.

Prof. P. H. Van der Weyde, the well-known scientist, died at his residence in New York on March 18. He was born in Nymegen, Holland, in 1813. He studied at Durpldorf, and graduated from the Royal Academy at Delft. He was a scientific writer and teacher in Holland, and professor of mathematics and natural philosophy at the Government School of Design. In 1849 he came to New York; he studied and graduated from the New York University Medical College in 1856, and practised medicine until 1859. In that year he was appointed professor of physics, chemistry, and higher mathematics at the Cooper Institute. He was also professor of chemistry in the New York Medical College. In 1864 the chair of industrial science was created for him at Girard College, Philadelphia. He resigned this professorship a few years later, and returning to New York, became editor of the *Manufacturer and Builder.*

Prof. Van der Weyde was well known to many engaged in the electrical profession. He was, a few years ago, an active member of the New York Electrical Society and was largely instrumental in building up that organization. He was of the old school and was thoroughly versed in the principles of science. He was also the inventor of many devices, including electrical apparatus. He was highly respected by all who knew him, and regarded as a reliable authority on all scientific matters.

A LESSON WITH A MORAL.

An appeal has been issued by the Executive Board of District Assembly 75, K. of L., for aid for the motormen and conductors who lost their positions through the recent trolley strike in Brooklyn. It is stated that many of these poor misguided men are starving, and the appeal in their behalf is very urgent. The appeal says :



MAYER'S NEW DYNAMO.

"Many of our brothers are still idle, having been blacklisted, and cannot secure employment either in Brooklyn or New York. The landlords are beginning to press them for rent, and in many cases evict them ; such cases—actual eviction—we must relieve.

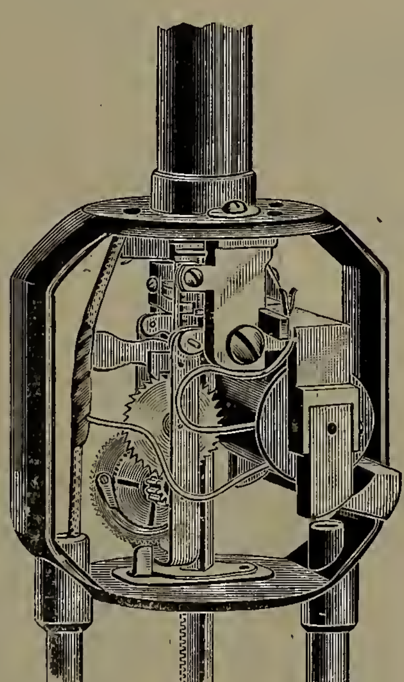
It is to be regretted that the executive board did not think of such a possibility long before they brought their dupes to the condition of utter hopelessness and starvation. The victims now realize to their sorrow what it means to be a party to a strike that was conducted as was that in Brooklyn.

THE SOLAR ARC LAMP COMPANY.

The Solar Arc Lamp Company, of 280 Broadway, New York, has recently established a number of new agencies throughout the country. These include the following named firms of prominence: F. P. Jones & Co., Buffalo, N. Y.; the Metropolitan Electric Company, Chicago; Commonwealth Electric Company, Philadelphia; Thompson-Brown Electric Company, Boston; Warg & Blomken, Milwaukee, Wis.; Widmer & Sprangley, New Orleans, La.

The company's manager has just returned from a successful trip, having obtained orders for a large number of Solar incandescent arc lamps for interior and exterior uses. One order alone calls for 134 lamps. These are to be used in lighting the interior of a mill.

The accompanying illustration shows the interior mechanism of the solar arc lamp. Simplicity of construction is its most noticeable feature, and it is, besides, positive in its feed action. There are no springs or dash-pot to complicate the operation of the lamp. The solar lamps are designed to run two in series on circuits from 95 to 125 volts, both burning alike. They are made to burn from six to fifteen hours, with candle-power varying from 300 to 2,000, and taking from four to ten amperes of current.



MECHANISM OF SOLAR ARC LAMP.

The Solar Company has enlarged its factory and testing room, in order to afford better facilities for handling its rapidly increasing business. The company's present output is highly satisfactory. One of its largest orders is for ornamental lamps to go in the new Odd-Fellows' Temple, Philadelphia, which will be one of the finest buildings in that city.

EXHIBITION OF TWO-PHASE SYSTEM IN BROOKLYN.

The Citizens' Electric Illuminating Company, of Brooklyn, on the night of March 22 gave an exhibition of the two-phase Stanley-Kelly-Chesney alternating system recently installed in its Rockwell place station for a practical test. The apparatus is placed in the large front room on the second floor of the station, where are also several of the Citizens' company's regular arc dynamos.

The object of the exhibition was to practically demonstrate to the invited guests the feasibility of operating arc and incandescent lamps and motors from the same generator and circuit, and as far as could be judged there was no room to doubt the success of the system in performing these varied functions. A 60-k. w. S. K. C. generator supplied a 2,000-volt current to various transformers placed about the room. The secondary circuits of the transformers included arc lamps, incandescent lamps and motors, each class of apparatus being controlled by its own transformer. There was a bank of several hundred incandescent lamps and a lot of arc lamps. Both burned with a steadiness and brilliancy that left nothing more in these directions to be desired. The incandescent lamp current was reduced to 100 volts; the arc lamps took 33 volts and the motors 500 volts.

The switchboard for the system was equipped with two S. K. C. ammeters, one voltmeter, and three switches. It was of white marble and stood out from the wall and above the floor, on a frame construction.

The test seemed to be a success in every way. A large number of prominent electrical engineers availed of the opportunity to witness the practical operation of this well-known system, and a very favorable impression seems to have been made on all present.

The Citizens' company has in contemplation the addition of a complete system of incandescent lighting, but up to a recent date has been handicapped by the incandescent lamp patent, which practically gave a monopoly of incandescent lighting to companies licensed by the General Electric Company. The incandescent field having been opened to competition by the recent decision of the Supreme Court in the Bate Refrigerator case, it is the intention of the Citizens' company to take advantage of the fact, and with that object in view, is looking into the merits of the Stanley-Kelly-Chesney two-phase system, as offering a safe and efficient service at reasonable rates. This system, the Company thinks, solves the load problem, and from what we can learn the officials look upon it with great favor, and will probably adopt it.

A large number of ladies were present at the exhibition, and the genial president of the company, Mr. Bernard Gallagher, and General Superintendent E. F. Peck gave their guests a warm welcome.

RECEIVER FOR THE LONG ISLAND TRACTION CO.

On Monday, March 18, the Long Island Traction Co., lessee of the Brooklyn Heights R. R. Co., Brooklyn, N. Y., passed into the hands of a receiver. Mr. Horace J. Morse, of A. M. Kidder & Co., Bankers, of New York, was appointed receiver by the United States Circuit Court of Virginia, in which state the Traction Co. was organized.

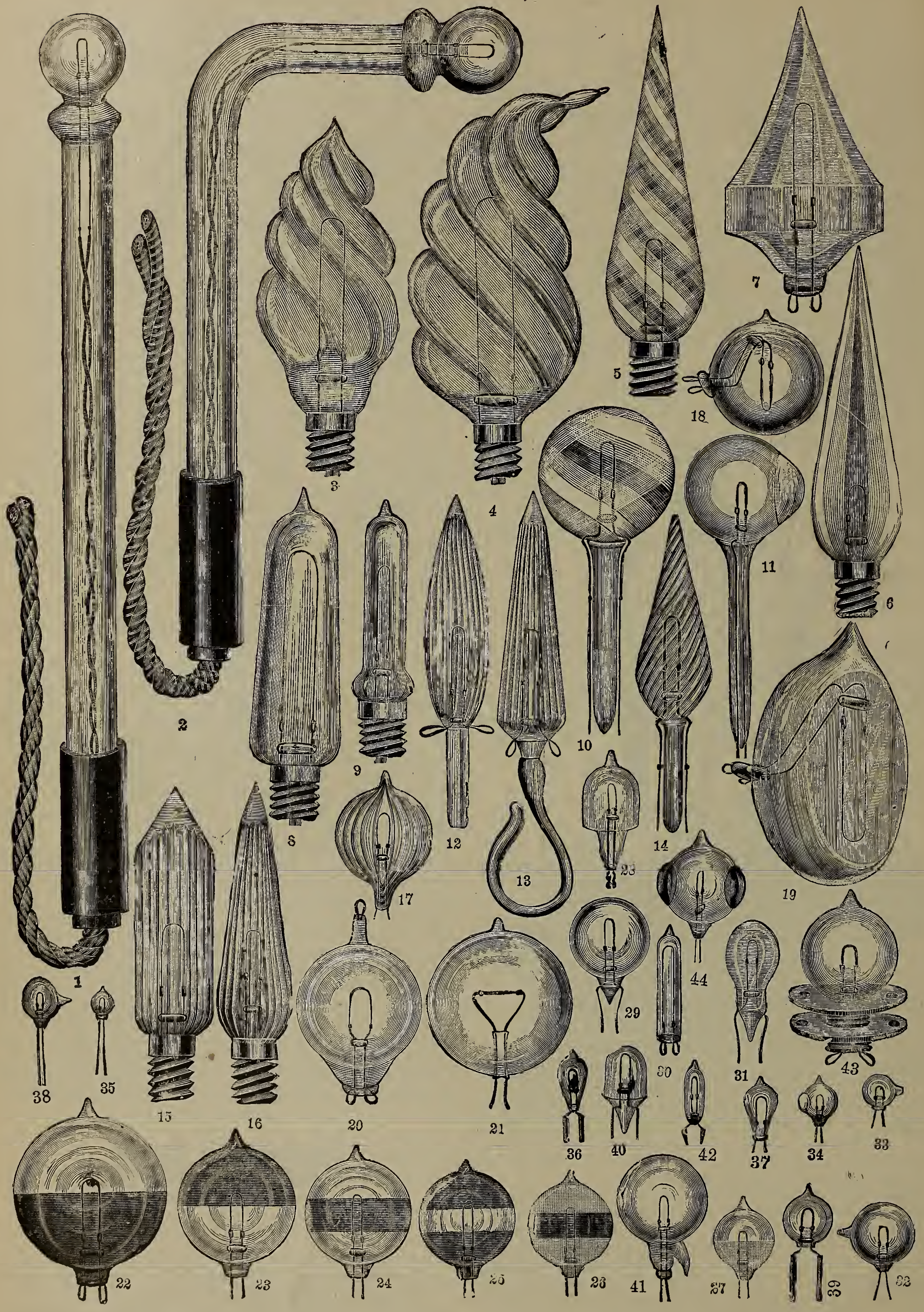
A circular was sent to the shareholders explaining the situation. Proceedings were threatened against the Long Island Traction Co., which, if taken, would in the opinion of committee (recently appointed to devise means, a plan to extricate the company from its financial difficulties) have been injurious to the best interests of the larger number of the creditors and stockholders of the company. Certain collateral trust noteholders of the company proceeded against the company in Virginia and the court referred to appointed a receiver as above noted. Before the receivership was contemplated the co-operation of a large number of the holders of the collateral trust notes had been secured in aid of reorganization, subject to the raising by the committee of $500,000 before March 28. The arrangement proposed with the assenting note-holders it is thought will insure the contributing stockholders greater protection than could be otherwise possible. The stockholders are urged, in furtherance of the plan, to contribute $2.00 per share.

Telephone Notes.

TELEPHONE PATENTS ISSUED MARCH 19, 1895.

PROTECTIVE DEVICE FOR ELECTRICAL APPLIANCES—Joseph J. O'Connell, Chicago, Ill., assignor to the American Bell Telephone Company, Boston. (No. 536,095).

ELECTRO-MAGNETIC SIGNAL—Theodore Spencer, Cambridge, Mass., assignor to the American Bell Telephone Company, Boston, Mass. (No. 535,104).



ILLUSTRATIONS OF SOME OF THE MINIATURE INCANDESCENT LAMPS MADE BY J. L. SOMOFF.

NOVELTIES IN MINIATURE INCANDESCENT LAMPS.

Mr. J. L. Somoff, of 11 Park Row, New York city, who for the last six years has been engaged in the manufacture of miniature incandescent lamps, has attained so wide a popularity amongst his customers that letters expressing their thanks for the excellence of his lamps come to him by the hundreds.

He has just issued a new catalogue of incandescent lamps which, in size and diversity, actually surpasses anything published here or in the old world. Mr. Somoff's catalogue contains 150 lamp cuts, which, however, do not represent all the styles made by him. Mr. Somoff's industry here has in the past, more than anything else, tended to widen the field of application of miniature lamps for decorative purposes, surgery and in scientific research.

For diagnosing diseases the aid of the electric lamp is a very important element. One of the finest of such lamps is the aseptic lamp shown in Fig. 1 of the large plate illustration. This lamp is used for investigating the throat and larynx. The same lamp, with a curved shank, is shown in Fig. 2. Both lamps are made entirely of glass and are strong and heavy.

These lamps, with those shown in Figs. 33, 34 and 35, are indispensable in making examinations in infectious diseases, since they can be easily disinfected. No. 35 is the smallest lamp made, being only ⅛-inch in diameter, with ½ candle-power, taking four to six volts and 4/10 of an ampere. Figures 32, 38 and 39 represent other endoscopic lamps of different designs.

No. 34 has a small lens fused on its surface to enable a better condensation of light upon a diseased spot.

For surgeons' head lanterns the lamps shown in Figs. 19, 20, 21, 28, 29 and 41 are employed.

The most wonderful of surgical instruments, the cystoscope, employs lamps shown in Figs. 36, 37, 40 and 42.

Figs. 3, 4, 7, 8, 9, 15 and 16 show lamps that are designed for interior decorative lighting. The first two are made up to eight c. p. and 52 volts, while the others are of lower voltage. They are made of various and artistic designs. The corrugations intensify and deflect the light from hundreds of points, rendering the effect very beautiful.

Figs. 5, 6, 11, 12 and 14 show other designs of decorative lamps, many of them being used by actresses for stage effects.

A series of unique decorative lamps is shown in Figs. 22 to 27. The globes of these lamps consist of two or three differently colored segments, for the purpose of modifying other colors and otherwise producing unique effects.

THE NEW ELECTRIC CONSTRUCTION AND SUPPLY CO.

Through the exertions of Mr. F. E. Kinsman, the "Electric Construction and Supply Company" has been reorganized, and will resume the business of its predecessor. The new company takes the same name as the old. The capital stock of the new concern is $12,000.

Mr. Kinsman was the original promoter, general manager and president of the old company for a number of years prior to 1889. He was prompted to rescue the business, believing that with sufficient working capital and the employment of a management which should enjoy the confidence of all the stockholders and the trade generally, would insure success, and his efforts, as already noted, have received prompt support.

The old company was the oldest organization of its kind in the country and represented the modern practice of arc lighting, which offers a most promising future.

As far back as 1884 Mr. Kinsman brought out the "Simplex" arc lamp to burn on incandescent circuits. He took Mr. Ward into the business with him, Mr. Ward producing the "Ward" arc lamp, which brought the company such a reputation.

PORTABLE PRIMARY BATTERY.

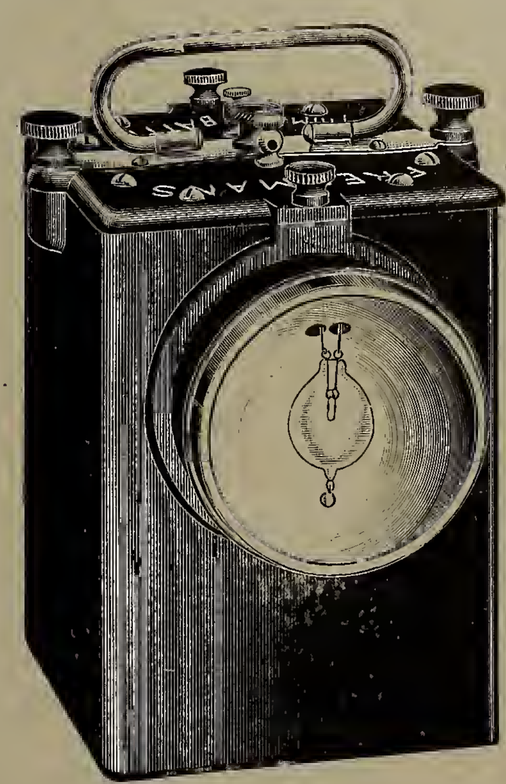
The portable primary battery recently put upon the market by the Newton Rubber Works, Newton Upper Falls, Mass., is claimed to be the only practical portable electric light and power battery made.

The company has conducted experiments with various patented devices and finally selected the one of the type illustrated herewith, which was invented by Warren P. Freeman. Mr. Freeman's reputation in the electrical trade is such as to insure the successful introduction of this battery. He is a practical, as well as theoretical, electrical and mechanical engineer, and has had a wide experience in the electrical field.

The outfit shown is designed to meet the demands for a practical and safe electric lamp for gas companies, fire departments, oil and varnish works, magazines, mines, railroads, warehouses, distilleries, signals, subways, stables, cabs and carriages, wreckers' use, divers, vessels of all kinds, boating, night fishing and general household use, spectacular effects, laboratory purposes, etc., etc.

On short circuit it delivers a current of 12 amperes at 8 volts.

The cell will light a four candle-power lamp for ten



PORTABLE PRIMARY BATTERY.

hours, at a cost not to exceed three cents, the lamp taking one ampere of current to bring it to candle-power.

The weight of the cell when fully charged is but 7½ lbs, and there is extremely small local action when the cell is not in use.

The company makes a bicycle lamp that weighs only 1½ lbs as made at the present time, but proposed changes in manufacture will reduce this weight half a pound. This battery will light a 1½ candle-power lamp for two hours for not more than three cents.

The portable power battery in appearance is exactly like that illustrated, except that it has no lamp or bull's-eye. It is intended for sewing machines, dental lathes, ventilating fans, and such work where power only is needed. One cell will run a 10-inch fan motor for eight hours on one charge. The company makes a battery fan-motor especially adapted to its battery.

The size of the cells for both light and power uses is six inches deep, 4¼ wide, and 4½ front.

The material of the cells themselves is a compound of Mr. Freeman's invention, which is said to be far superior to any hard-rubber compound. It is proof against the action of acids, which is a very important advantage.

The Newton Rubber Works is meeting with much success in the introduction of this meritorious battery. The company is well-known to the electrical trade in general, through its manufactures of hard and soft rubber goods.

CANADIAN NOTES.

C. F. Gildersleeve, general manager of the Richelieu and Ontario Navigation Company, is calling for tenders for six dynamos and six engines and one thousand incandescent lamps. Parties desiring to supply the above can get specifications and all information by addressing 228 St. Paul street, Montreal.

Mr. Geo. A. Cox has been elected a director of the Toronto Street Railway, to fill a place on the board made vacant by the resignation of Mr. J. W. Leonard.

The Niagara Falls and Lundy's Lane Electric Street Railway Company, of Niagara Falls, Ontario, is applying for incorporation, with a capital stock of $50,000, to construct a street railway or lines of street railway in the municipalities of the town of the Niagara Falls, the village of the Niagara Falls, and the township of Stamford, Ontario.

The Packard Lamp Company, Montreal, now called the Packard Electric Company, is moving to its new factory at St. Catherines, Ontario.

Mr. M. W. Corbitt, of Montreal, who has for the past four years been known through his connection with the electrical fraternity of this city as agent for the Edison General Electric Company, and later with the Royal Electric Company, and also with the Montreal Electric Company, is now associated with the firm of Robert & Co., of Montreal, manufacturers' agents for mill clothing and mill supplies. Mr. Corbitt has, however, not quite lost sight of his old love, and will doubtless be glad to see his old time friends and give them prices on motors, dynamos and other electrical apparatus.

The Canadian General Electric Company is supplying the Winnipeg Street Railway Company with a 600-h. p. direct connected railway generator. This machine will be of the company's standard multipolar type, similar to the 1,200-h. p. generator recently installed by it for the Toronto Railway Company.

Mr. J. R. White has lately been appointed secretary-treasurer of the Montmorency Electric Light and Power Company, of Quebec.

The Montreal Electric Company, agents for the Fensom Elevator Company, of Toronto, report having changed over freight and passenger elevators in Nordheimer's building, Montreal, from hydraulic to electric. The freight elevator is run by a 6-k. w. belted motor, while the passenger is operated by a 7-k. w. motor direct connected. The machines are connected to a 250-volt circuit. E. W. S.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

At the regular monthly meeting of Council, held March 20, the following associate members were elected:

Boyles, Thomas D., electrical engineer, General Electric Co., Schenectady, N. Y.

Davis, W. J., Jr., electrical engineer, General Electric Co, Schenectady, N. Y.

Duncan, John D. E., Pittsfield, Mass.

Esty, William, instructor in electrical engineering, State University, Urbana, Ill.

Frost, Joseph W., secretary, National Automatic Fire Alarm, 335 Broadway, New York city.

Garrels, W. L., student, Westinghouse Electric and Mfg. Co., St. Louis, Mo.

Gilmore, Lucien H., assistant in physics, Stanford University, Palo Alto, Cal.

Grist, James E., mechanical engineer, Phila. Traction Co., Philadelphia, Pa.

Hiss, Wm. J., Jr., senior in electrical dept., Lehigh University, Bethlehem, Pa.

Jones, Henry C., Election Construction and Supply Co., Montgomery, Ala.

Larrabee, Rollen N., Western Electric Co., New York city.

Middlemiss, P. R., New Orleans, La.

Mora, Mariano L., C. E., E. E., New York city.

Mosman, Chas. T., electrical engineer, General Electric Co., Schenectady, N. Y.

Mershon, Ralph D., electrical engineer, Westinghouse Elec. and Mfg. Co., Pittsburgh, Pa.

O'Sullivan, M. J., superintendent, Electric Light, B. & O. R. R. Co., Baltimore, Md.

Patton, Price I., Sheble & Patton, Ltd., 1022 Arch st., Philadelphia, Pa.

Shock, Thos. A. W., electrical engineer, Electric Light and Power Co., Sacramento, Cal.

Stanton, Chas. H., 1517 Walnut st., Philadelphia, Pa.

Stratton, Alex., Crocker-Wheeler Electric Co., New York city.

The following associate members were transferred to membership:

Powell, William Henry, electrician, Mather Electric Co., Manchester, Conn.

Kimball, Alonzo S., professor of physics and electrical engineering, Worcester Polytechnic Institute, Worcester, Mass.

Mix, Edgar Woods, electrician, Thomson-Houston International Electric Co., Paris, France.

As required by the rules of the institute the council canvassed the nominating papers received from the membership and prepared the following ticket:

For President: Dr. Louis Duncan of Baltimore.

For Vice-Presidents: Dr. M. I. Pupin of New York city; W. F. C. Hasson of San Francisco, Cal.; Angus S. Hibbard of Chicago.

For Managers: Carl Hering of Philadelphia; Dion J. Arnold of Chicago; Charles F. Scott of Pittsburgh; Dr. Cary T. Hutchinson of New York city.

For Treasurer: George M. Phelps of New York city.

Three vice-presidents and managers hold over by the rules as follows: Vice-Presidents—Prof. W. A. Anthony, Prof. Francis B. Crocker, and James Hamblet of New York.

Managers—Prof. Harris J. Ryan, of Ithaca, N. Y.; Chas. Hewitt, of Philadelphia; J. J. Carty and W. J. Hammer, of New York; A. E. Kennelly of Philadelphia, and W. D. Weaver, Chas. S. Bradley and W. B. Vansize of New York.

At the meeting of the institute at 12 West 31st street, in the evening, eighty members and guests were present.

A paper on "A Method for Preventing Armature Reaction," by Prof. H. J. Ryan and Milton E. Thompson was read by the former. The discussion was participated in by Townsend Wolcott, W. L. Bliss, E. A. Merrill, Dr. C. T. Hutchinson, C. S. Bradley, C. O. Mailloux, Dr. C. E. Emery, A. E. Kennelly, G. S. Dunn and Maxwell M. Mayer.

EXPORTS OF ELECTRICAL APPARATUS AND APPLIANCES.

The Treasury Department has just issued a statement showing the value of electric light appliances, telegraph and telephone instruments exported from the United States during the last fiscal year, and the countries to which the same were exported; also a statement of the imports of crude and manufactured gutta-percha during the same period.

The total value of the exports of electric light appliances was $650,418. The following statement shows the countries to which these goods were exported, and the value of the same, by countries:

Countries To Which Exported.	Values.
Austria-Hungary	$ 103
Azores and Madeira Islands	332
Belgium	2,066
Denmark	571
France	3,274
Germany	4,399
Italy	907
Netherlands	1,659
Portugal	725
Russia, Black Sea	16
Spain	58

Sweden and Norway	151
Turkey in Europe	826
United Kingdom :	
England	82,906
Scotland	15,279
Ireland	123
Bermuda	1,304
British Honduras	423
Dominion of Canada :	
Nova Scotia, New Brunswick, etc.	16,555
Quebec, Ontario, etc	88,184
British Columbia	4,116
Newfoundland and Labrador	4,362
Central American States :	
Costa Rica	2,128
Guatemala	5,101
Honduras	1,063
Nicaragua	3,340
Salvador	1,650
Mexico	40,459
Miquelon, Langley, etc	135
West Indies :	
British	14,691
Danish	625
Dutch	1,094
French	925
Haiti	11,124
Santo Domingo	3,952
Spanish-Cuba	40,725
Puerto Rico	5,336
Argentine Republic	32,870
Bolivia	111
Brazil	45,316
Chile	12,132
Colombia	10,889
Ecuador	3,993
Guianas :	
British	4,064
Dutch	341
French	191
Peru	7,115
Uruguay	3,656
Venezuela	13,550
China	5,154
East Indies :	
British	21,451
Dutch	46
Hongkong	11,560
Japan	3,345
Russia, Asiatic	18
Turkey in Asia	187
All other Asia	671
British Australasia	94,493
French Oceanica	844
Hawaiian Islands	5,868
Philippine Islands	2,740
British Africa	7,936
Canary Islands	412
Liberia	38
Portuguese Africa	234
Turkey in Africa:	
Egypt	17
All other Africa	81
All other British	182
All other islands and ports	220
Total	$ 650,418

The total value of exports of telegraph and telephone instruments was $1,534,277, as follows:

Countries to Which Exported.	Values.
Austria-Hungary	$ 125
Azores, and Madeira Islands	228
Belgium	41,618
Denmark	1,458
France	79,329
Germany	101,515
Italy	15,958
Netherlands	1,123
Portugal	210
Russia, Baltic and White Seas	7,775
Russia, Black Sea	1,094
Spain	835
Sweden and Norway	1,865
United Kingdom :	
England	371,656
Scotland	8,300
Bermuda	3,371
British Honduras	41
Dominion of Canada :	
Nova Scotia, New Brunswick, etc.	16,691
Quebec, Ontario, etc	170,885
British Columbia	11,C03
Newfoundland and Labrador	3,039
Central American States :	
Costa Rica	10,853
Guatemala	11,856
Honduras	1,092
Nicaraugua	477
Salvador	11,520
Mexico	110,864
West Indies :	
British	19,514
Danish	604
Dutch	2,374
French	192
Haiti	6,460
Santo Domingo	6,486
Spanish—Cuba	143,501
" Puerto Rico	5,650
Argentine Republic	29,382
Brazil	100,857
Chile	23,303
Colombia	27,623
Ecuador	3,310
Guianas :	
British	16,736
Dutch	45
Peru	10,713
Uruguay	1,759
Venezuela	47,983
China	2,898
East Indies—British	773
Hongkong	35,998
Japan	34,600
Turkey in Asia	50
All other Asia	90
British Australasia	7,503
French Oceanica	82
Hawaiian Islands	12,562
Philippine Islands	4,007
British Africa	3,359
Turkey in Africa—Egypt	821
All other Africa	110
Total	$1,534,277

The value of gutta-percha manufactures (dutiable) imported during the same period was $30,654, and that of crude gutta-percha, which is free of duty, was $84,340. The total weight of the crude gutta-percha was 498,763 pounds.

THE GENERAL ELECTRIC AND WESTINGHOUSE CONSOLIDATION.

Rumors regarding the proposed consolidation of the General Electric and Westinghouse interests continue to circulate. It was reported in Wall street on Friday last that an agreement for a pool of the patents of the two companies had been drawn. The report, however, could not be verified. It is asserted that committees were appointed by both concerns some time ago, to which was assigned the

task of devising some arrangement by which better prices could be obtained for the products of the two companies. The report of these committees, it is stated, has not yet been made.

New Corporations.

The Belmont Construction Company, Charlottesville, Va. by H. G. Wills, president; W. W. Keenan. secretary and treasurer; J. J. Holliday, J. E. Harrison, G. E. Head and others. Capital stock, $5,000.

The Onondaga Dynamo Co., Onondaga, N. Y., by Jas. W. Eager, David Cronin and Ella H. Eager. Capital stock, $250,coo.

The Home Telephone Co., Baltimore, Md., by Frank Noble of New York, W. S. Risley of Camden, N. J., C. H. Ware of Baltimore, and W. J. Atkinson, of New York. Capital stock, $500,000.

The Union Telephone Co., Easton, Md., by M. M. Higgins and A. G. Pascault. Capital stock, $5,000.

The Parkersburg Traction Co., Parkersburg, W. Va., for the purpose of building an electric line in that city.

The Citizens' Electric Light and Power Co., Newark, Ohio, by Wm. G. Taafel, Wm. D. Fulton, Frank G. Warden, Frank Owens and Wm. E. Miller. Capital stock, $30,000.

The Fishkill Electric Railway Company, to build and operate a street surface railroad from the village of Matteawan to the village of Fishkill; capital, $50,000; John T. Smith, E. K. Tompkins, Charles H. Watson, John Place, W. Weston, B. L. Smith, of Fishkill-on-Hudson; S. K. Phillips, W. H. Southard, of Matteawan, and Wilbur H. Weston, of Newburgh.

The Atlanta Electric Power Company, Atlanta, Ga., by A. E. Thornton, Atlanta; J. H. Vail, Hugh R. Garden, New York; Evan P. Howell and others. Capital stock, $100,000.

Trube Automatic Thermo-Regulator and Power Equipment Company, Albany, N. Y., by Jacob Heffelfinger, Emil Heffelfinger, John Trueb and others. Capital stock, $25,000.

The Lock Haven Traction Company, Lock Haven, Pa., by C. A. Bragg, A. J. Martin, R. H. Irvine and others.

The North Carolina Pin and Bracket Company, Wilkesboro, N. C., by F. B. Kennier, R. A. Spainhour and F. G. Holman.

The North Shore Telegraph Company, Grand Marais, Minn., by Edward B. Lewis and C. E. Bateman. Capital stock, $100,000.

The Dirigo Telegraph and Telephone Company, Augusta, Me., by Hon. P. O. Vickery, F. E. Southard and J. R. Gould.

The Thomasville Electric Light Company, Thomasville, Ga, by W. R. McIntyre, J. H. Davidson and S. L. Hayes. Capital stock, $20,000.

The Galesburg Telephone Company, Galesburg, Ill., by O. F. Price, Robt. Chappell and E. S. Cunnell. Capital stock, $50,000.

The Franklin Electric Illuminating Company, Glen Cove, N. Y., by Louis T. Duryea, James Norton and Henry Nores, Glencove, N. Y.; D. W. Pardee, Sea Cliff. Capital stock, $25,000.

The Cushman United Telephone Co., Chicago, Ill., by I. M. Cushman, O. O. Leabharte and Jos. Barton. Capital stock, $20,000,000.

The Wichita Merchants' Telephone Co, Wichita, Kan., by W. A. Minnick, G. W. Clements, J. M. Shakelford, and others.

The Incandescent Light and Fuel Company, Carthage, Mo., by S. E. Wetzel, J. L. Moore and C. Wright. Capital stock, $25,000.

The White River Water Power Co., Tacoma, Wash. Capital stock, $2,000,000.

The Merchants' Electric Light Co., East Liverpool, Ohio. Capital stock, $20,000.

The Montrose Telephone and Telegraph Co., Montrose, Pa.

The North Shore Telegraph Co., St. Paul, Minn. Capital stock, $100 000.

The Gilliland Telephone Co., Ministee, Mich. Capital stock, $15,000.

The East Greenwich and Warwick Railway Co., East Greenwich, R. I., by Irving M. Smith.

The Monticello and Neversink Traction Co., Monticello, N. Y., for the purpose of building a line between Monticello and Grahamsville.

The Electric Construction and Supply Co.. New York city, by Arthur A. Lawrence and Frank E. Kinsman, of Plainfield, N. J., and others. Capital stock, $12,000.

The Maine Lighting Co., Portland, Me., by Arthur C. Libbey, president, and L. W. Tibbetts, treasurer. Capital stock, $10,000.

A company has been organized in Atlantic City, N. J., by New York and Atlantic City capitalists for the purpose of building an electric road from Atlantic City to New York. Capital stock, $4,000,000.

The Middleburgh and Oak Hill Telephone Co., Middleburgh, N. Y., by Elias W. Dutton, Azano B. Brayman, W. J. Chase, William Earle, Geo. Graham, Absalom Graham, and others. Capital stock, $50,000.

The Lake Park Street Railway Co., Waxahachie, Texas, has been incorporated with a capital stock of $5,500.

The Kansas Telephone and Electrical Co., Parsons, Kansas.

Possible Contracts.

John Magee, Lansingburg, N. Y., is interested in a project to establish an electric light plant in that place.

John W. Taber, of Shreveport, La., is in the market for a complete equipment for a telephone system in that place.

The Ballston Railroad Co., Ballston, N. Y., is to introduce electricity on its lines.

It is proposed to establish a municipal plant in Chelsea, Mich.

The Southern Electric Light Co., Philadelphia, Pa., will soon erect a large power house on property adjoining Gray's Ferry Arsenal.

The Kinderhook and Hudson Railway Co., Hudson, N. Y., is considering the advisability of adopting electric power on its line.

The Salamanca Water Works, Salamanca, N. Y., is endeavoring to secure permission to supply the village with electric lights.

The Exchange National Bank, Wheeling, W. Va., will erect a new building. The building is to have a complete electric light plant.

D. R. Burgess and E. O. Zadek are interested in the proposed establishment of a telephone system in Mobile, Ala.

W. D. Davis, Statesboro, Ga., proposes to install an electric light plant.

H. Y. Bready, engineer, Baltimore, Md., can give par-

ticulars regarding the contracts for the construction of the Baltimore, Severn Park & Annapolis Railroad.

The Western Electric Co. has secured the contract for building electrical subways in Baltimore, Md.

Kinston, N. C., proposes to build an electric light and water-works and will shortly hold an election to decide the matter. The Mayor can give further information.

Paul Reyman, Wheeling, W. Va., has secured a contract for the erection and equipment of an electric light plant in Elm Grove, W. Va.

An opera house is to be erected in Charleston, S. C., to cost from $125,000 to $150,000. It is to be equipped with electric lights and electric passenger elevators. Proposals will be received by the Exchange Banking & Trust Co., Charleston, S. C.

An electric light outfit for a place of 2,000 inhabitants is wanted by W. D. Davis of Statesboro, Ga.

M. L. Dame, of the Harriman Co-operative Telephone Co., Harriman, Tex., wants fifty complete telephone outfits.

W. E. West, Milledgeville, Ga., is in the market for materials for the construction of telephone lines.

The Citizens' Telephone Co., Lancaster, Pa., is in the market for 800 telephone equipments. E. T. Fraim may be addressed.

The Thirteenth Regiment of Pennsylvania will build a new armory in Scranton. Col. E. H. Ripple is the president of the new armory association.

A new school is to be built in New York city to cost $180,000. Superintendent of school buildings can give further information.

C. W. Wilmeroth, Vicksburg, Miss., will build a large match factory, in which all modern machinery will be introduced.

Baldwin & Pennington, 44 South st., Baltimore, Md., have prepared plans for a new passenger station and ferry house for the Staten Island Rapid Transit Co., to be built in New York city.

An electric light plant is to be established in Green Island, N. Y., to cost 20,000.

An electric light plant is to be established in Morrisville, N. Y.

The Cohoes City Railway Company, Cohoes, N. Y., will advertise for bids for the construction of its road.

The Syracuse and East Side Railway Company, Syracuse, N. Y., has been granted permission to construct, maintain and operate a single-track electric street railway through certain streets of the city. H. F. Stevens, city clerk, can be addressed.

The electric lighting of Ogdensburg, N. Y., is contemplated. The town clerk can furnish detailed information.

New York Notes.

OFFICE OF THE ELECTRICAL AGE,
WORLD BUILDING, NEW YORK,
MARCH 25, 1895.

The building trades' strike, including that of the electrical workers, which has been on for several weeks, was declared off on March 21. It is stated that about 200 electric wiremen are left out in the cold.

At a meeting of the Rapid Transit Commission on March 22, resolutions were passed defining the route of the proposed lines, and changing the general plan of construction so as to bring the cost of the work as near as possible to the $50,000,000 limit. The proposed changes will reduce the cost to $49,850,000.

Mr. F. S. Holmes, Electrical and Mechanical Engineer, 108 Fulton Street, New York, has had a wide experience in his line, and has made quite a reputation for accuracy and completeness of his work. He has had many responsible contracts and all have been carried out in the most successful manner. All who require expert services in his line should see Mr. Holmes.

Mayor Schieren, of Brooklyn, has vetoed the resolution passed by the council fixing the rate of speed at six, eight and ten miles an hour, and allowing three passengers to ride on the front platforms. The mayor thinks ten miles an hour is too fast; eight would be safer. He also objects to allowing any one on the front platform but the motorman. He believes the motorman should not be hampered for space.

The big building to be erected on Sixth avenue by Siegel, Cooper & Co., of Chicago, will have eight electric passenger elevators and at least as many freight elevators. The building will also be lighted throughout by electricity. Electric power will also be used to operate a unique screw device to be used in lowering packages, etc., from the various floors to the delivery wagons. The total cost of ground and building will be between $3,500,000 and $4,000,000, and the establishment will be ready for business by May 1, 1896.

On March 22 Judge Lacombe, in the United States Circuit Court, dissolved injunctions issued on July 7, 1893, restraining several electric light companies and others from infringing the Edison lamp patent, which was rendered void by the recent decision of the Supreme Court of the United States in the Bate Refrigerator case. The parties thus relieved of restraint are the Sawyer-Man Electric Company, the Mount Morris Electric Company, Edward May and Julian A. May; the United Electric Light and Power Company, Caleb H. Jackson et al.; William Zinsser and Mary J. Van Doren, Holland House Company, Herbert M. Kinsley and Gustave Baumann. W. T. H.

TO RETURN CAR FARES.—A bill has been introduced in the California legislature which provides that fares shall be returned to passengers when street cars are stopped for more than ten minutes for any cause whatever.

TAX ON POLES.—An ordinance pending in Lancaster, Pa., proposes to levy a tax of $500 annually for the privilege of erecting poles and stringing wires in that city. Two companies are seeking charters and are resisting the measure.

Trade Notes.

The Brush Electric Co., Cleveland, Ohio, has received the contract to supply generators and motors for the Port Norfolk R. R. Co., Norfolk, Va.

The interest of Mr. Bailey in the Adams & Bailey Electric Co., Elkhart, Ind., has been purchased by Mr. Adams. Hereafter the company will be styled The Adams Electric Co. Mr. J. M. Adams is secretary and treasurer.

The Jaeger Mfg. Co., 169 William street, New York, has issued an illustrated catalogue of the miniature electric lamps made by this concern. This company makes a great variety of small lamps for every purpose.

The W. C. Vosburgh Mfg. Co , Ltd., 269-281 State street, Brooklyn, the well-known manufacturers of gas, electric and combination fixtures, has just issued two catalogues containing illustrations of goods of latest design. They are numbered 18 and 19; No. 18 relating to electric and combination fixtures and No. 19 to gas fixtures. Any responsible dealer can obtain copies of these catalogues by writing to the company and mentioning the ELECTRICAL AGE.

THE RATING OF FEED-WATER HEATERS.

The Feed-Water Heater Manufacturers' Association, of New York, on January 26, last, passed resolutions regarding the rating of feed-water heaters.

In effect these resolutions state that the only proper rating of feed-water heaters is one based upon the square feet of heating surface contained in the heater; that hereafter the subscribers, when called on for prices, will state the exact number of square feet of surface offered, and that they will state in their catalogues the total square feet of heating surface in each heater offered. The resolutions were signed by the Taunton Locomotive Manufacturing Company, makers of the Wainwright Feed-Water Heater; Benj. F. Kelley & Son, makers of the Berryman Feed-Water Heater; Wm. Baragwanath & Son, makers of the Baragwanath Feed-Water Heater; the Goubert Manufacturing Company, makers of the Goubert Feed-Water Heater; the National Pipe Bending Company, makers of the National Feed-Water Heater; Robt. Wetherill & Co., makers of the Wetherill Feed-Water Heater; Keystone Engine and Machine Works, makers of the Keystone Feed-Water Heater.

Mr. Frank A. Thayer, 14 Church street, New York, is the secretary of the association.

WOVEN WIRE BRUSHES.

The Belknap Motor Co., of Portland, Maine, are the patentees and manufacturers of the best woven wire commutator brush on the market.

Electrical and Street Railway Patents.

Issued March 19, 1895.

535,838. Incandescent Electric Lamp. William S. Lowe, Lima, Ohio. Filed Oct. 15, 1892.

535,840. Electric Arc Lamp. George R. MacIntyre, New York, N. Y. Filed July 5, 1894.

535,841. Electric Arc Lamp. George R. MacIntyre, New York, N. Y. Filed July 5, 1894.

535,842. Electric Arc Lamp. George R. MacIntyre, New York, N. Y. Filed July 10, 1894.

535,865. Electric Sign-Changing Device. William Sears, Boston, Mass. Filed Feb. 19, 1894.

535,885. Accumulator Plate. Georges R. Blot, Paris, France. Filed May 22, 1894. Patented in France May 29, 1893, No. 230,422; in Belgium Nov. 17, 1893, No. 107,189; and in England June 30, 1894, No. 10,169.

535,917. Induction Coil. Albert F. W. Meyer, Blue Island, Ill. Filed Nov. 27, 1894.

535,936. Conduit Electric Railway. Fred P. Bergh and Charles W. Tarbox, New York, assignors to David Calman, same place. Filed May 25, 1894.

535,948. Electric Program-Clock. Fred Frick, Waynesborough, Pa. Filed May 28, 1894.

535,971. Insulated Trolley Section and Crossover. Montraville M. Wood, Chicago, Ill., and Charles K. King, Mansfield, Ohio, assignors to the Ohio Brass Company, Mansfield, Ohio. Filed July 13, 1894.

535,993. Closed Conduit Electric Railway. James F. McLaughlin, Philadelphia, Pa. Filed Oct. 23, 1894.

536,032. Alternating-Current Motor. Maurice Hutin and Maurice Leblanc, Paris, France, assignors to the Société Anonyme pour la Transmission de la Force par l'Électricité, same place. Original application filed Nov. 17, 1892. Divided and this application filed Feb. 14, 1895. Patented in France March 19, 1890, No. 204,456; in Germany July 31, 1890, No 63,446; in Belgium Jan. 9, 1891, No. 93,385; in England Jan. 12, 1891, No. 584; in Italy Jan. 13, 1891, XXV, 28,966, LVII, 14; in Spain March 5, 1891, No. 11,690; in Austria-Hungary June 16, 1891, No. 3,851, and No. 22,375, and in Switzerland Sept. 12, 1891, No. 3,968.

536,055. Apparatus for Automatically Limiting Speed of Electric Cars. Louis S. Wright, Philadelphia, Pa. Filed Dec. 8, 1894.

536,076. Collapsible Conduit for Electric Railway Conductors. Harry C. Grant, New York, N. Y. Filed Sept. 17, 1894.

536,095. Protective Device for Electrical Appliances. Joseph J. O'Connell, Chicago, Ill., assignor to the American Bell Telephone Company, Boston, Mass. Filed Nov. 23, 1894.

536,104. Electro-Magnetic Signal. Theodore Spencer, Cambridge, assignor to the American Bell Telephone Company, Boston, Mass. Filed Sept. 10, 1894.

536,153. Tip for Flexible Electric Conductors. Charles H. McEvoy, Lowell, Mass. Filed Feb. 4, 1895.

ELECTRICAL AGE

VOL. XV., No. 14. NEW YORK, APRIL 6, 1895. WHOLE No. 412

ESTABLISHED 1883.

Entered at New York P. O. as second-class matter, January 18, 1891.

THE ELECTRICAL AGE PUBLISHING CO., PUBLISHER

TERMS OF SUBSCRIPTION:

One Copy, one year,	$3.00
One Copy, six months,	1.50
Great Britain and other Countries,	4.00

Cable Address (all Cables,) "Electage," New York.

W. T. HUNT, President F. N. BASSETT, Vice-President.

T. R. TALTAVALL, Secretary and Editor.

NEWTON HARRISON, E. E., Scientific Editor.

Canadian Representative, E. W. SAYER, Montreal, Que.

ADDRESS ALL COMMUNICATIONS TO

THE ELECTRICAL AGE PUBLISHING COMPANY,

FIRST FLOOR, WORLD BUILDING.

NEW YORK.

NEW YORK, APRIL 6, 1895.

CONTENTS.

A HORSE-POWER IN A WATCH-CASE

There is no vision more alluring, no failure more conspicuous than the attempts of earnest workers to take from coal its imprisoned force—not in quantities of a deplorable smallness, but with a degree that will enable us to reduce our present heavy fuel consumption and our large, inefficient and expensive machines to a mere trifle of their present bulk. How shall this problem be attacked, and if attacked, what chance is there for a speedy fulfilment of our hopes? In a paper by Alfred H. Bucherer, read before the Franklin Institute, the situation is strongly outlined. He inclines toward a treatment that belongs to the field of thermo-dynamics. Starting with the simple equation for the heat of reaction, he says the heat of reaction is equal to the electrical energy developed, less the heat absorbed in the cell. Developing the problem from this standpoint he investigates the conditions resulting from a combination, not of carbon with oxygen, but of carbon monoxide with oxygen. When the two gases are mixed together they do not entirely combine, but only to an extent which greatly depends upon the heat of the respective gases. Such being the case, a range of conditions prevail which imply a corresponding change in the production of electromotive force with every variation in temperature. The E. M. F. resulting from such a combination can be expressed in definite figures. It will be 1.41 volts at 0° Celsius, and at 13° Celsius 1.406 volts, for a mixture of two of carbon monoxide to one of oxygen. Oswaldt has presented conclusions to us in a manner that will bear the light of the strongest criticism. Obtain an inconsumable electrolyte separating the carbon in any form from the oxygen, and all the energy developed which would otherwise be radiated as heat will now be directly transformed. The chemical energy of the combining materials will be skilfully guided, by all the arts that nature has placed in our hands, to blend imperceptibly into this better and more useful form of electricity.

ELECTRICITY ON STEAM ROADS.

All great convulsions in nature are anticipated by a thousand forewarnings. The world is ripe today for changes that are but expected—that have sent their heralds before them in the shape of preliminary action—that may bring on a state of renaissance sufficient to make our engineers kick their very heels together with delight. This condition of affairs is not arriving; it has arrived. If millionaire corporations, with the touch of King Midas, backed by men of unexcelled shrewdness, not only propose but execute a change from steam to electricity on their own roads, can any doubt exist as to the future immensity of the scheme from every possible practical standpoint? The New York, New Haven and Hartford Railroad Company will be the pioneer in this work. One of its eastern lines will be completely "trollified," and the steam locomotive thrown to one side, like Jake Sharp's car horses, as unfit for the demands of this progressive age. Although this news, in itself, was cause for sufficient happiness, the bubble of excitement was not allowed to burst, but was swelled to unwonted proportions by the additional announcement of a sister company. The New York Central and Hudson River Railroad Company will operate a trolley road between Buffalo and Niagara Falls in place of the traditional locomotive (with its 4 per cent. efficiency). Power transmitted from Niagara Falls, costing not more than $12 a year per h. p., can find its ideal application in electric railroad practice. We have here the conditions which defy the use of any other power than electricity. Hitherto the fault has been in the cost of production; now, with turbines of over 80 per cent. and a road of at least 40 per cent. efficiency, we can rest with the absolute assurance that perfection, as far as human endeavors are concerned, has now been reached.

THE STORAGE BATTERY IN TELEGRAPH OFFICES.*

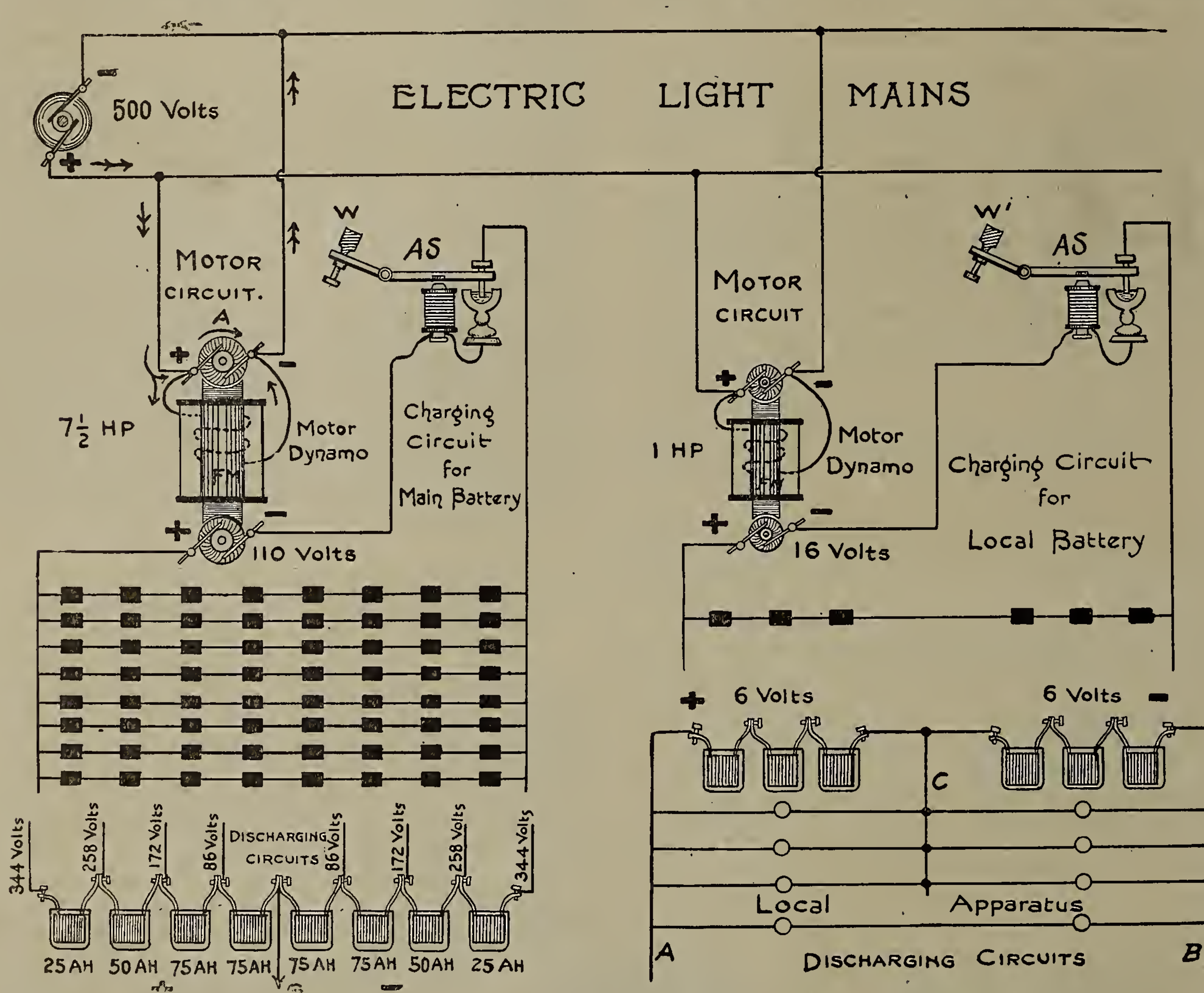
BY WM. FINN.

The largest, and by far the most important, storage battery installation in this country for telegraphic purposes has just been made in the main office of the Western Union Telegraph Company at Atlanta, Georgia, where the seventy telegraph lines entering that office, in addition to all its local circuits, are now drawing current from an accumulator plant of 700 chloride cells, only one-half of which, however, are occupied at any one time in furnishing the electrical energy that previously required as many as 8,000 gravity cells.

The battery equipment consists of 344 cells of 75 ampere-hour, 172 cells of 50 ampere-hour and 172 cells of 25 ampere-hour capacity for the main lines, besides 12 cells of 250 ampere-hour capacity for the local circuits.

The current for charging these cells is not, in this case, derived directly from the electric light mains, but from two of the figure represents the manner of charging and discharging the local batteries, of which there are also two sets, each consisting of six cells; one set being joined in "series," in the charging circuit, while the other is being discharged (in "series") through the local circuits. The latter, it will be observed, are all run and operated on the three-wire system; a difference of potential of about 12 volts being maintained between the principal leads, A and B, and half that voltage between the neutral wire, C, and the outer leads. As this voltage is somewhat higher than was previously employed, the local instruments are wound to a resistance of 20 ohms each, an additional 20 units of "dead" or inductionless resistance being inserted in each circuit with a view to reducing the "time constant," or, in other words, quickening the action of the local apparatus.

The distinguishing feature of the Atlanta installation consists of the transforming machinery, the necessity for which arises from the fact that no suitable supply of direct current can be secured in that city for the necessary purpose of charging the accumulators. Now, as the special



STORAGE BATTERY INSTALLATION, WESTERN UNION TELEGRAPH OFFICE, ATLANTA, GA.

motor-dynamos or direct current transformers of seven and a half horse-power and one horse-power respectively, which are interposed between the electric power company's supply wires and the accumulator cells, the latter being represented by the black squares in fig. 1. The larger of these machines reduces the primary pressure of 500 volts to 110 volts for charging the main batteries, while the smaller machine reduces it to 16 volts for charging the local batteries.

The main batteries, of which there are two sets that alternate daily between the charging and discharging circuits, are divided into eight groups of 43 cells, which are charged in the "multiple series" and discharged in the "simple series" arrangement, shown to the left of fig. 1, which also illustrates the method of connecting up the motor-dynamo, with the supply mains on the one hand, and with the storage cells on the other. The opposite side function of a motor-dynamo is to convert any available existing condition of direct electrical pressure and volume into such new condition as the requirements may happen to call for, it will be seen that machines of this class are extremely useful where any kind of a current is desired of a different character from that obtainable from electric light wires or other sources. In the case under consideration, for example, one of the motor-dynamos converts the undesirable 500-volt power current of the Georgia Electric Light and Power Company into 110 volts—a pressure better adapted to the purpose of charging the main line batteries—while the other transformer accomplishes a similar purpose with regard to the charging of the local cells, which require but a comparatively low-pressure current on account of the smaller number of cells involved.

Besides the apparatus above enumerated, the Atlanta equipment includes an elaborate switchboard upon which have been placed three Weston ammeters and two Weston

*Telegraph Age, New York.

voltmeters, for testing the strength and pressure of the currents; twelve double-knife switches for effecting the necessary battery transpositions from one circuit to another; nine rheostats whose resistances are utilized to vary the charging currents, as well as to equalize the pressure from each group of storage cells; twenty-two fuse blocks for protecting the batteries from short-circuiting, and about 300 resistance lamps, which also serve as a protection to the batteries in case of "short circuits" at the instruments, besides indicating by their glow the nature of certain "troubles" that are apt to arise in the line wires to which they are attached.

ELEGANT LIGHTING FIXTURES.

It would be hard to find any goods to surpass in design and finish those illustrated herewith. Their beautiful ap-

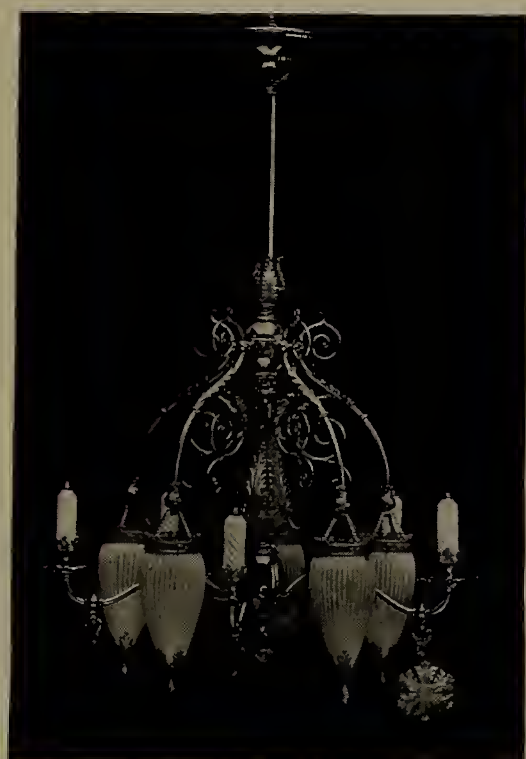


FIG. 1.

pearance arrests the attention of the eye at once and leaves little more to be desired in that direction. Beauty is not their only quality, however; they are serviceable as well.

The fixtures illustrated are among some of the latest de-

FIG. 2.

signs gotten out by the W. C. Vosburgh Mfg. Co., Ltd., of Brooklyn, N. Y. They show that in the matter of refinement in art lighting fixtures adapted to electricity, as well as gas and electricity combined, are keeping well up to the standard of taste and character of work.

In Fig. 1 is shown a rare specimen of modern renaissance treated in a style adapted to its character, and as a combination fixture; that is, it may be used either

FIG. 3

for electricity or gas, or both. It is neither overdone with detail, nor gross in bulk, but unites with the delicate grace of the acanthus leaf the simplicity of modern lines of ornament.

In Fig. 2 is found the best elements of the renaissance combined to produce a striking design. It is difficult to avoid the besetting sin of too much ornamentation, but here the highly ornamental band for the centre disk is used with rare artistic taste, and the fixture itself is elegant enough to satisfy the art critic.

FIG. 4.

Fig. 3 represents a graceful and novel effect for an electrolier, following up the renaissance school so much in vogue, and Fig. 4 is a very artistic production showing the adaptability of brass for design and domestic purposes.

It is needless to add that the W. C. Vosburgh Mfg. Co., Limited, is making rapid progress in artistic novelties, and in its warerooms, both in Brooklyn and Chicago, may be seen designs in every style, including Colonial, Rococo, Empire, etc.

The company's factory, 269-281 State street, Brooklyn, is one of the largest and most complete plants of its kind in the country. Every class of work is produced, from the plainest fixture to the most elegant.

"LITTLE GIANT" WATCH DEMAGNETIZER.

The best of watches become unreliable as time-keepers when they become magnetized. It is difficult to prevent a watch becoming magnetized, but fortunately it is easier to demagnetize it when it becomes afflicted with the magnetic disease.

Many devices have been invented to demagnetize watches, but the one illustrated herewith is said to be the simplest and most reliable in its action of any yet produced.

The "Little Giant" fully eradicates all traces of magnetism in watches, without taking the movement apart or even removing the case. It is made in three sizes, adapted to all currents supplied by electric light companies.

Style "A" machine (Fig. 1) is designed for use on 110 to 120-volt direct currents.

Style "B" (Fig. 2) is made for 110-volt alternating current and performs its work as readily and perfectly as style "A" machine does for the current for which it is built.

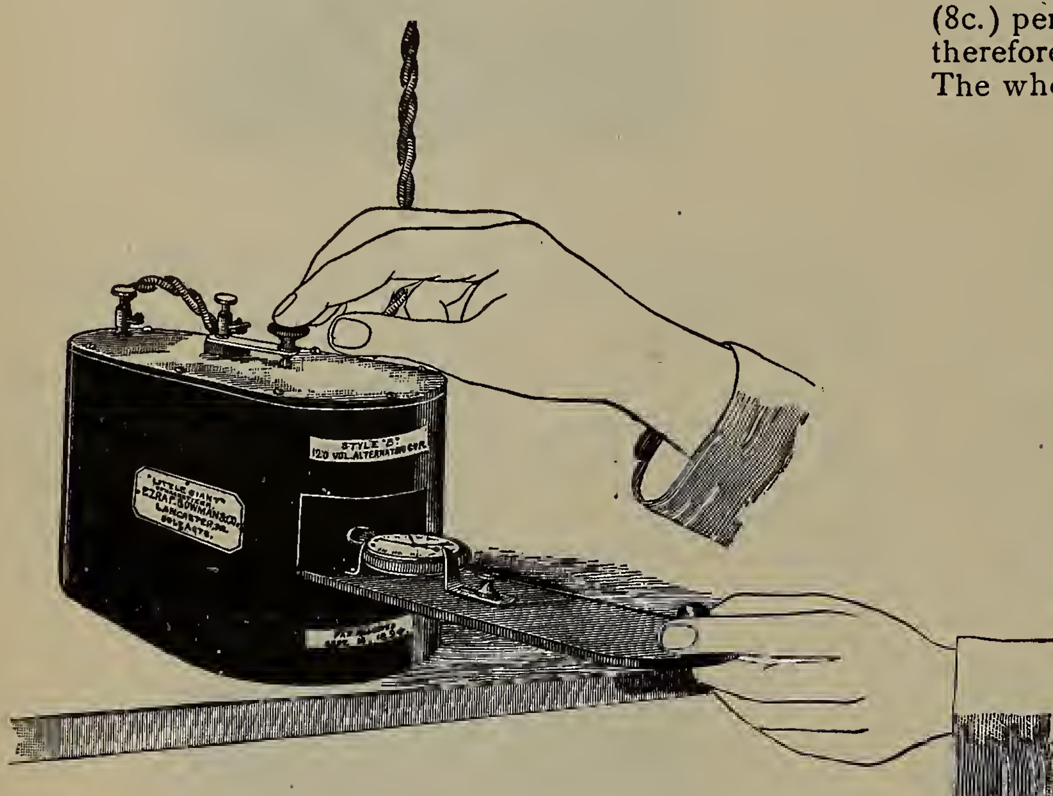


FIG. 1.

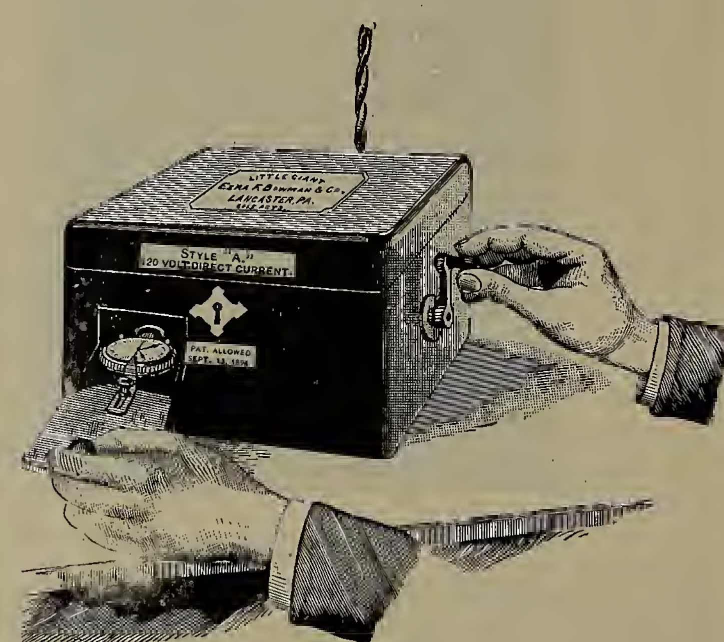


FIG. 2.

Style "C" is made for 52-volt alternating current, and is as reliable in its action as either of the other two machines. In appearance it is exactly like style "B."

The "Little Giant" demagnetizers are manufactured by Ezra F. Bowman & Co., Lancaster, Pa. These machines are giving excellent satisfaction, as they are infallible in their work.

HEATING A LONDON THEATRE BY ELECTRICITY.

The managers of the Vaudeville Theatre, London, recently tested the advantages of electric heating, by applying four large electric radiators to heating the theatre. The radiators had an aggregate heating surface of 36 square feet, and took 12 amperes of current from the lighting circuits. A week's trial gave excellent results, and the managers have given an order for radiators to be fixed around the skirtings on either side and along the front of the orchestra. The radiators are of "box" or "wall" form, that is, they have a front radiating surface studded with projections fixed into cast-iron boxes, which are screwed by means of lugs and insulators to the walls and partition. Each box radiator is two feet long and one foot wide, and, therefore, offers a radiating surface of two square feet. The air is allowed to circulate between the casing and the wall, so that an extra heating surface is obtained. There are six box radiators on either side of the theatre, and twelve attached to the partition in front of the orchestra. The latter are cased in at the back, and a good current of air is obtained by carrying the casing below the boxes containing the radiators. Four wall sockets are fixed, two on each side, and four on the chair supports in the centre of the stalls. By means of these connectors the radiators may be employed to warm the centre before the performance begins, and afterward removed to the sides. Each radiator, portable and fixed, has a patent safety connector, and can be detached from the circuit at will. The radiators reach the usual temperature of hot-water pipes, and they are found to produce quite sufficient heat. The average temperature of the theatre inside after the radiators have been working a reasonable time is about 60° (*i. e.*, temperate) when the corridors are about 40°. Arrangements have been made for warming the stage. The current taken by each large portable radiator is twelve amperes, and the small box radiators take three amperes each, making in all a total of 114 amperes, but as only two of the larger radiators are found necessary, the current actually used for warming the auditorium is 90 amperes at 100 volts. Thus it will be seen that nine units per hour are required when the whole apparatus is in full work, and the cost,, at 4d. (8c.) per unit, is 3s. (72c.) per hour. To warm the theatre. therefore, for a period of four hours the cost is 12s. ($2.88), The whole or any number of the electric radiators may be put on or cut off at will, and there is no fear of overheating the theatre and making it uncomfortable at any time.

ELECTRICITY ON THE NEW YORK CENTRAL ROAD.

It is reported from Buffalo that the New York Central Railroad Company, has decided to change the motive power on its Niagara Falls branch from steam to electricity. Orders, it is stated, have been issued to begin at once on the work of changing systems, and it is expected to have the line ready under the trolley system for the summer business. It is supposed that the power will be furnished by the Niagara Falls Power Company.

Mr. H. Walter Webb, third vice-president of the N. Y. Central Railroad, confirmed the report. He said:

"We are surprised that we did not think of the idea before, and are still more surprised to find how cheaply we can make the change. Our tracks up there are not in use all of the time, and it will be possible to run frequent trains at a high rate of speed to accommodate local traffic, in a way that would be impossible on a steam railroad. The power to operate our trains can be obtained from the Niagara Falls Power Company, in which some of us are heavily interested. Special cars of the observation pattern will probably be built so as to give passengers a fine view of the river and falls.

"The present plan contemplates a trolley system of such power that the improved coaches can be drawn over the line at the same rate of speed as at present. The fares

will be reduced, and the comfort will be far greater, as there will be no cinders, smoke and other inconveniences of a steam railway. We hope to have the road ready when the excursion season opens, at the latest, as there is little to be done in making the change."

KEYSTONE INSTRUMENTS.

The Keystone ammeters and voltmeters are making a reputation for themselves that promises to place them in the front rank.

Accuracy, of course, is the main desideratum in a measuring instrument, and this quality exists in the highest attainable degree in the Keystone instruments.

These instruments are claimed to be superior in point of accuracy to anything in the market. They are not affected by external magnetism, which is another very important requisite in an accurate instrument, for, if any external magetism affects the mechanism of the instrument, its accuracy cannot be depended upon.

The readings are direct, and as the instrument is deadbeat, the pointer comes to rest quickly.

The instruments are free from heating errors, and in every other respect are about as perfect as it is possible to make them in the light of present knowledge.

The Keystone instruments are made both for direct and alternating currents. The alternating voltmeters are made in two sizes. viz, for 80 volts and 130 volts. The ammeters come in sizes varying from 35 to 300 amperes.

Direct current voltmeters come in four sizes, from 125

COLGATE'S KEYSTONE INSTRUMENT.

volts to 600 volts, and the ammeters range from 50 amperes to 10,000 amperes.

These instruments are handsome in design and appearance. They are made by skillful workmen, and highly finished.

The George L. Colgate Company, 136 Liberty street, New York, are the sole factors of the Keystone instruments, and they report that their instruments are rapidly growing in favor and use.

HOW TESLA CREATES LIGHT.

Between us and the sun stretches the tenuous, sensitive ether, and every sensation of light that the eye experiences is caused by the effect of five hundred trillions of waves every second impressed on the ether by the molecular energy of the sun travelling along it rhythmically. If the waves have a lower frequency than this five hundred trillions, they will chiefly engender heat. In our artificial methods of getting light we imitatively agitate the ether so poorly that the waves our bonfires set up rarely get above the rate at which they become sensible to us in heat, and only a few waves attain the right pitch or rapidity to cause the sensation of light. At the upper end of the keyboard of vibration of the ether is a high, shrill and yet inaudible note—"light"—which we want to strike and to keep on striking; but we fumble at the lower, bass end of the instrument all the time, and never touch that topmost note without wasting the largest part of our energy on the intermediate ones, which we do not at all wish to touch. Light (the high note) without heat (the lower notes) is the desideratum.

* * * * * * *

Now, Mr. Tesla takes his currents of high frequency and high potential, subjects the incandescent lamp to them, and, skipping some of those intermediate wasteful heat stages of lower wave vibration experienced in the old methods, gets the ether-charged molecules more quickly into the intensely agitated condition necessary to yield light. Using his currents, produced electro-magnetically, as we have seen, to load each fugitive molecule with its charge, which it receives and exercises electrostatically, he gets the ether medium into a state of excitement in which it seems to become capable of almost anything.—Thomas Commerford Martin in the *Century* for April.

ELECTRICITY AT THE BORDEAUX EXHIBITION.

At the exhibition which will be held in Bordeaux, France, from May to November, this year, there will be a special building called the "Palais de L'Electricité," which will be devoted solely to electrical apparatus and machinery. The prospectus of this department, which is Section 9, group 32, shows the following distribution of the various classes of exhibits:—Class 123—The study of electricity and magnetism; 124—Industrial production of electrical energy; 125—Electric lighting; 126—Electric transmission of power, and electric traction; 127—Electro-metallurgy and electro chemistry; 128—Telegraphy, telephony, and signalling; 129—Medical electricity; 130—Various applications. The secretaries are M. A. Marton, 14, Rue des Augustins, Bordeaux, and M. Georges Vène, 15, Rue Sainte-Catherine, Bordeaux, from whom all particulars can be obtained.

ELECTRICAL ENGINEERING AT LEHIGH UNIVERSITY.

On Tuesday evening, March 26, Mr. Klinck, of the class of '95, read a paper before the Electrical Engineering Society of that institution on "The Jablochkoff Candle." A specimen of the candle was exhibited and its construction and action explained. Mr. Klinck then showed some curves taken by himself exhibiting the horizontal distribution of the light. Some difficulties met with in arc light photometry were mentioned and the apparatus used was briefly explained.

Mr. Blehl, '95, presented a paper on "Vector Analysis as applied to Alternating-Current Problems." This was essentially the same as previously given before the society and the mathematical club, but was repeated by request, some new details being added. E. C. Brown, '95, supplemented the preceding by explaining a few problems to which the principles just enunciated apply.

TENDENCIES OF MODERN ELECTRICAL RESEARCH.

Prof. M. I. Pupin, on Monday evening, March 25, delivered at Columbia College, New York, before the New York Academy of Science, a lecture entitled "Tendencies of Modern Electrical Research." The lecture was divided into five sections, as follows: 1. Statement of the two principal groups of modern electrical research; 2. Brief review of the law of evolution of physical concepts; 3. Bearing of the law of evolution of physical concepts upon the modern electro-magnetic theory, and 5. The aim of the electro-magnetic theory of light.

Quite a number of electrical people were present, and the lecture throughout was listened to with deep attention.

M. B. Leonard.—Mr. M. B. Leonard, of the Chesapeake and Ohio Railroad Company, has been appointed vice-president of the Association of Railway Telegraph Superintendents, to fill the vacancy caused by the death of E. R. Adams, of the Philadelphia and Reading road. Mr. Leonard is telegraph superintendent of the Chesapeake and Ohio road, with headquarters at Richmond, Va.

PRENTISS STANDARD ENGINE LATHE.

The engine lathe shown in the accompanying illustration is a machine of great utility in electrical work.

It has an 18-inch swing, and is designed to handle light or heavy work quickly and easily.

The journals are large and carefully finished, the front bearing being $2\frac{1}{16}$ inches diameter x $4\frac{3}{4}$ inches long.

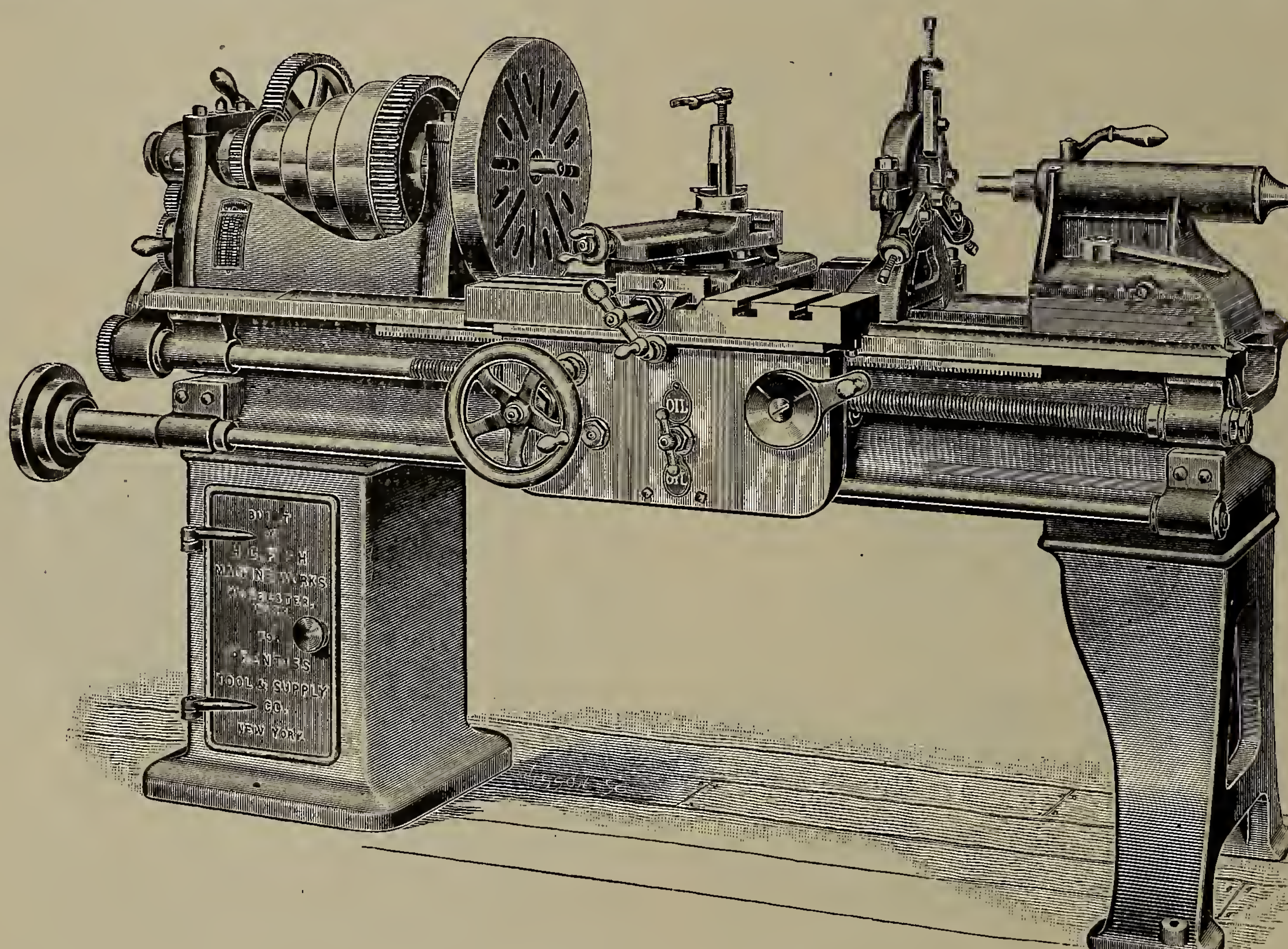
The spindle is made of hammered crucible steel, and has a $1\frac{5}{16}$ inch hole through its entire length.

The boxes are of hard phosphor bronze, and are so designed that new ones can be substituted at any time, and easily set in perfect alignment.

The lead screw and all actuating screws are made of special grade of steel.

The carriage has an extra long bearing on ways, and the tool-block also has a long bearing on carriage.

Provision is made for withdrawing the pinion from the rack when screw cutting, which also prevents the possibility of engaging both feeds at the same time.



PRENTISS' ENGINE LATHE.

The cabinet leg is fitted with a box with separate places for each of the change gears, wrenches, etc.

Each lathe is furnished with large and small face plates, steady rest, set of change gears for screw cutting (including $11\frac{1}{2}$ threads for pipe) and friction countershaft, and will be furnished with plain gib or compound rest as required.

This lathe is made for the trade by the Prentiss Tool and Supply Company, 115 Liberty street, New York, and 62 and 64 South Canal street, Chicago.

Machine Telegraphy.—The United States Postal Printing Co. has opened an office in Baltimore, and is ready to receive messages for Washington. The company has built lines between the two cities and proposes to extend them to Philadelphia, New York and Boston. The system used by the company is the invention of J. H. Rogers, of Hyattville, Md. The messages are perforated on a paper tape by means of a typewriter. The slip is then passed into the transmitting instrument, and the message is received on a printing machine at the receiving office. It is stated that the machine will transmit 200 words a minute.

THE INCANDESCENT LAMP VS. THE WELSBACH BURNER.

BY WM. GOLTZ.

Experiments with the Welsbach burner have been made for seven years, but only during the last two years has the same been so improved that it has become quite a competitor of the incandescent lamp.

There is no doubt that the Welsbach burner offers advantages which, to say the least, are and have been an inducement to many consumers to install this light. It not only does away with two of the principal objections to ordinary gas burners—insufficient light and flickering—but it also materially lessens the cost to the consumer. The latter point may be illustrated by the following data, which although procured from the enemy's camp, I think are nearly correct:

One Welsbach burner using about 3.2 cubic feet of gas per hour gives about 60 candle-power, and is, therefore, the equivalent in candle-power to about $3\frac{3}{4}$ 16 candle-power lamps. Assuming the price of gas to be $1.00 per thousand feet, and of electric light .01 cent per ampere hour, we would obtain the following result: One Welsbach 60 candle-power light, consuming 3.2 feet per hour costs 3-10 cent, and $3\frac{3}{4}$ 16 candle-power lamps, consuming $1\frac{7}{8}$ amperes per hour, cost $.01\frac{7}{8}$ cents. Now it is evident that although the figures relating to the Welsbach burner are only obtainable under the most favorable conditions, that is, with a gas of high thermal power and a new mantle of the very best material, the difference is sufficiently large to induce many people to install this wonderful illuminant without going to the trouble of considering any other points, and the effect these figures have already had can be seen by the fact that an alarmingly large number of these burners have already been introduced throughout this country. In many cities you will see in stores, show-windows, small hotels, and in fact, wherever running expenses are an important item, combination fixtures where the incandescent lamps are out of commission and where the gas outlets, which had long been out of use, have been fitted with Welsbach burners. The people who so readily installed these lights at the rate of $2.50 apiece

would perhaps not have done so had they taken into consideration that the monthly gas bill is not the only item of expense connected with this light. Mantles are apt to give out frequently, renewals costing 50 cents, and the glass chimneys are subject to breakage, while mica chimneys, although unbreakable, become smoked and must be thrown away. Almost in every instance the breakage of a chimney means the breakage of a mantle also, and the economy of the Welsbach is, therefore, not quite as striking as may appear to the casual observer.

One of the reasons why the Welsbach burner does not comply with the former condition is its color. The bare statement that a light is of so many candle-power really conveys no accurate information at all. Artificial light is generally produced by raising some body to a high temperature. As soon as the temperature is sufficiently high, it parts with some of its energy in the form of radiation. At first, the radiations are not of a kind to which the eye is sensitive; they are of greater wave length than red light and may be called infra red. As the temperature increases the infra red radiations increase, and presently there are added radiations which the eye perceives as red light; and, subsequently, while the red light increases, yellow, green, blue and violet rays are successively thrown off. The rays of the incandescent lamp, similar to those of the candle, are largely composed of red and yellow, while those thrown off by the Welsbach burner combine an abundancy of green and blue, and those of an arc lamp all of these colors, with violet added to them. In other words, while the temperature of the filament of an incandescent lamp when burning at its rated voltage is such as to generate as large a proportion as possible of such rays as are most pleasant for the human eye, that of the Welsbach, being considerably higher, will cause the production of rays containing a larger proportion of yellow and blue rays than is desirable for a majority of indoor purposes. I have heard numerous complaints from people who have used the light for some time, to the effect that it ruined their eyes, acknowledging that they made a mistake in putting it in.

* * * * *

Another claim advanced by the Welsbach people as an inducement is the cheapness of installation. Now, it is almost impossible to make any comparison in this respect, as the cost of installing electric lights is dependent upon different circumstances in each and every case. I may say, however, that to wire a store or office or a similar place for incandescent lamps, the wire to be concealed under molding or mounted upon insulators and the lamps to be suspended by means of flexible cord, costs about one-half what it would cost to have existing gas fixtures fitted with Welsbach burners. It is a well-known fact, at least to the majority of those present here, that wiring of this description is usually done for about $1.00 a light, while the cost of installing Welsbach burners is at least $2.50 apiece. Where new electric fixtures are to be installed, it is only fair to compare the cost with that of new gas fixtures and the result would be about the same. Add to this the extreme unsightliness of this burner, including glass chimneys, corrugated opal shades and holders and the impossibility of throwing the light in the direction it is usually most wanted, that is, downward, and you will have to acknowledge that cost, notwithstanding the points are all in favor of the glow lamps.

LEGAL.

MONTGOMERY COUNTY RY. CO. *vs.* PENNSYLVANIA R. R. CO.

On March 25, the Pennsylvania Supreme Court, in the case of the Montgomery County Railway Co. *vs.* the Pennsylvania Railroad Co., reversed the decision of the lower court which was favorable to the trolley line. The plaintiff sued to secure the right of way at the crossings of the Pennsylvania Railroad along the route of its lines. The substance of the Supreme Court's decision is that the street railway act gave no right of eminent domain and that, as the trolley lines are incorporated under that act, they have no power to construct their roads where the taking of property is incident or necessary to it without the consent of the property-owners.

The practical effect of the decision, it is said, is to strike down about $50,000,000 of capital invested in trolley lines over the state. It will not materially affect the city trolley companies, who can secure the right of way from City Councils, but the suburban roads will be compelled to confine themselves to highways, or else secure relief from the legislature.

NEW YORK INSULATED WIRE CO. *vs.* WESTINGHOUSE CO.

The New York Insulated Wire Co., 15 Cortlandt street, obtained an attachment on March 27, against the Westinghouse Electric and Mfg. Co. for $35,397. The latter company gave bonds for $40,000, furnished by Brayton Ives and Marcellus Hartley, and the attachment was vacated.

The claim grows out of a dispute over a contract for wiring work at the World's Fair in Chicago, in June, 1892. The Westinghouse company obtained the contract and gave the sub-contract to the New York Insulated Wire Company, which did all the wiring work between the fixtures and dynamos. It is claimed that the Westinghouse company received $260,719 from the World's Columbian Exposition and paid to the New York Insulated Wire Co., $229,329. The latter company also included a small claim for extra work done.

INTERIOR CONDUIT AND INTERIOR WIRING.

BY C. E. BURTON.

It is claimed that by the use of this conduit the objectionable features formerly found in concealed wiring have been eliminated. It gives to a system of wiring mechanical protection, additional insulation, and above all, the ability to withdraw and reinsert wires at any time without damage to the building or any of its decorations, should the insulation of the system become impaired. It is probably useless to describe with any minuteness the interior conduit system, as it is to be hoped that it has been sufficiently advertised and presented to most of you, so that its good qualities have been readily understood. The system consists virtually in equipping a building throughout with insulated pipes, thereby providing continuous insulated raceways or channels for the reception of the wiring. The complete system provides, in addition to the conduit, various forms of junction, cut-out and outlet boxes; and all varied conditions of interior wiring have been met and provided for in this system. Interior conduit is now furnished in three forms—the plain conduit, brass armored and iron armored. The plain conduit, which was the original form, is manufactured by building up tubes of special paper, the paper being wound on a mandrel spirally and the different layers cemented together; after seasoning the tubes are boiled in preparations that render them impervious to moisture and practically fireproof. Many millions of feet of this kind have been installed, but to meet the demands of greater mechanical strength the brass armored conduit was introduced, which is simply the plain conduit having a sheathing of brass drawn over it by special machinery. The necessities and exacting conditions of modern construction demanded something having more mechanical strength than the existing types of conduit, hence to meet these requirements was brought out the iron conduit, which is the plain conduit forced into an iron pipe in such manner as to secure a positive union of the conduit and the iron. This tube is built to fill all the requirements of flexibility and permanency desired by engineers, and is fast assuming a popularity that must be gratifying to manufacturers.

Relative to the cost of installing interior conduit it has been demonstrated in actual practice that it will require

approximately an additional expenditure of 20 per cent. for plain conduit, 40 per cent. for brass conduit; these figures being based on the cost of installing interior conductors in the old method, that is, boring holes through the joist, and with no regard to ordinary safety precautions; that if the wiring system is installed in compliance with modern regulations, that, is the bushing of all holes with insulating material, and the wiring system being supported by wholly non-combustible insulators Interior conduit can be used at a cost averaging not more than 10 per cent. for plain conduit and 20 per cent. for brass armored conduit in addition to the cost of the method last above noted. These figures, obtained from actual installation, are average figures given by a number of contractors who have installed wiring by both methods. The installation of this conduit is very easily accomplished; in fact, no previous experience is actually necessary beyond a few initial instructions as to the proper methods of making joints and economical methods of using the conduit.

ELECTRO-CHEMICAL PROGRESS DURING 1894.*

BY J. SWINBURNE.

Chlorate of potash is now being made electrolytically from muriate of potash. This is a simple process. The anodes are platinum, which is not attacked appreciably in an alkaline solution. There are various patents for details of vats, and so on, but no master patents, so that there is a fair field for commercial work. There are chlorate of potash works at Vallorbes, in Switzerland, at Ottawa, and large works are either being put up, or now in operation, in Sweden. The price of chlorate is now under 5½d. a pound, and this is, doubtless, to some extent, due to the electrical works.

Caustic soda and bleaching powder have always tempted the electro-chemist, because the total turnover is so enormous; but, on the other hand, there is less chance of a large profit on products that are sold by the ton. The anode difficulty stands where it did, the only promising solution being the use of a cheap form of carbon, such as rough retort carbon, which can be cheaply replaced as it wears away.

The number of improved forms of vat, and of curious developments of porous cell, increases daily, and each inventor generally thinks that the industry was waiting for his particular little plan, and that he has solved the problem, whereas the difference in expense of working one kind of vat and another is generally a very small matter. The Electro-Chemical Company, which was formed last January, had some difficulty in finding suitable premises. These have now been purchased, and plant for 1,100 horse-power is being put down. The boilers and some of the vats are in, and the whole will most likely be at work in a few months. The Allgemeine Elektricitäts Gesellschaft is putting down 2,000 horse-power for soda manufacture. It will, however, take many thousands of horse-power to make any appreciable portion of the chemicals now used.

Ozone has attracted very many inventors. Messrs. Siemens & Halske, of Berlin, have been working at this development for some time and have obtained interesting and important results, but I do not know how far I am at liberty to describe what was shown me as a matter of courtesy. Mr. Andreoli has been doing good work, and bleaching as well as sterilizing and disinfecting by ozone may become an important industry in the future, but is hardly so yet.

Experimental work has been carried on actively in various directions, notably the reduction of nitro-compounds, such as nitro-benzol. Vautin's process for separating silver from gold by using the gold as anode and fused chloride of silver as electrolyte, deserves mention as a very simple way of conducting an otherwise troublesome process.

A large and influential company, with R. W. Wallace as one of the directors and with Lord Kelvin as scientific adviser, has been formed for manufacturing aluminium electrically in this country. This company also owns a simple method of soldering the metal.

An experimental plant is at work in a brewery hurrying vinegar manufacture considerably; but, again, I am not at liberty to describe it. Mr. Ferranti is also reported to be hurrying the manufacture of white lead electrically.

Messrs. Cowper-Coles and others are at work on real galvanizing; that is to say, coating with zinc by electrolysis. Though electro-zincing was abandoned in the old days in favor of dipping, with modern machinery and modern knowledge available, zincing can be done better electrically.

The stripping of scrap tin is no longer a problem to be solved; the problem is to find the scrap tin that has to be stripped.

The electrolysis of other people's water-pipe is now quite a large industry in the United States, but, as usual, we are behind in this country, and very little has been done in that line, though it is hoped that 1895 will be a good year for electrical traction.

Electro-chemistry as an industry is in a unique position. It wants development, but in most new industries there are prizes in the way of valuable patents to be won; but the electrolytic manufacture of nearly every commercial chemical to which electrolysis could be applied has been described, and often, to some extent, worked out by enthusiastic people who are dead; and there are hardly any master patents to be got. The only things to protect are small details of construction or working.

* London *Electrical Review.*

CANADIAN NOTES.

The Royal Electric Co., Montreal, has about completed its new factory. It will shortly move into its new quarters and manufacture electrical apparatus on a larger scale than heretofore.

The Merchants' Telephone Co., Montreal, the latest opponent to the Bell, has a good part of its exchange in shape and is now operating some 800 subscribers. The complete metallic circuit system is used.

Mr. F. H. Seddell, so long with the Royal Electric Co., of Montreal, has just severed his connection with that firm to take a position with D. A. Starr, electrical engineer, with offices in the Board of Trade Building.

The Royal Electric Company hockey dinner was held a few evenings ago. Mr. H. H. Henshaw, treasurer of the company, acted as chairman. A unique bill of fare was prepared, the name of each dish having an electric attachment of some sort. One dish was "young turkey electrocuted at 10,000 volts." "Fuse blown" sauce was served with the chicken fricassee, and the strawberry tarts were "shunt wound." The winding of the diners was so carefully proportioned that their speed was practically constant under the greatest possible variations of load.

E. W. S.

PRINCIPLES OF DYNAMO DESIGN.

Owing to the continued illness of Mr. Newton Harrison the continuation of his article on Principles of Dynamo Design has been deferred. Mr. Harrison is regaining his health, however, and assures us that he will be able to resume his work in time for our next issue.

TELEPHONE WAR.—The Gilliland Telephone Co., of Chicago, recently obtained a franchise to establish an exchange in St. Joseph, Mich., and proposed to charge a rental of $24 a year for each instrument. The Bell Telephone Company, which has for years been charging $48 a year, has cut its rates to $18. It is expected that a war of rates will follow.

ELECTRICITY DIRECT FROM COAL.*

BY ALFRED H. BUCHERER.

The endeavors of scientists and inventors to convert directly the potential energy of coal into electrical energy have received a fresh incentive from the interesting experiments of Dr. Borchers. So alluring are the rewards that follow the solution of this problem that men known for their conservative attitude in similar questions have hailed with extravagant expressions of delight the seeming results of the German electro-metallurgist. It is true the latter deserves high credit for testing his ingenious idea; yet from his own account of the facts brought out in his experiments, I feel sure that as yet his endeavors have been fruitless. Such failure, it is only just to note, could not have been foreseen from the standpoint of our present knowledge of electro-chemistry. In the extensive discussion of Dr. Borchers' work, which appeared in various technical and scientific journals one point has been altogether ignored, and this point is of such essential importance in the problem of the conversion of the potential energy of coal into electric energy that it deserves to be fully elucidated. This point is the relation of chemical to electrical energy. Dr. Borchers erroneously supposed that it would be possible to obtain an amount of electrical energy from the reaction $2CO + O_2 = 2CO_2$ that would be equal to the heat of formation of as much of the quantity of the reacting substances as take part in the transformation. Since v. Helmholtz has shown that such a view does conflict with facts, it is no longer legitimate to assume its correctness, still less to base upon it efficiency calculations, as was done by Dr. Borchers and Ostwald (see *Zeitschrift f. Phys. Chem.*, 1894, p. 521.)

The maximum amount of work which we can derive from a chemical reaction is a definite quantity, and is independent of the kind of energy into which it is transformed. Suppose we have an unpolarizable cell and make the external resistance extremely large as compared with the internal resistance; then, if the quantity m of electricity has passed through the circuit, a proportional amount of chemical action has occurred, and the heat developed in the external circuit is equal to the electrical energy obtained. On examination we will find now that although the internal resistance was vanishingly small compared with the external resistance, yet heat has been evolved or absorbed in the interior of the cell, and it follows from the law of the conservation of energy that the heat of reaction Q is equal to the electrical energy E, minus the heat q absorbed in the cell.

$$E - q = Q$$

(1) $$E = Q + q$$

q can have a positive value or a negative value, according to whether heat was absorbed or evolved in the cell. If we consider one electro-chemical equivalent involved in the transformation and measure Q and q in electrical units, then $E = Q + q$ where E measures the E.M.F. in volts. V. Helmholtz investigated the relation which q has to E by applying the second law of thermo-dynamics. The following reasoning is similar. We know that the mechanical energy of a perfect engine working between the temperature limits $T + dT$ and T is

$$dW = q\frac{dT}{T}$$

(2) $$q = T\frac{dW}{dT}$$

Now, since the second law of thermo-dynamics holds for the transformation of heat-energy into any other form of energy, it must be true for the transformations occurring in a galvanic cell. Now, as mentioned above, the E.M.F of a cell measures the energy, if we consider the amount of transformation effected by one electro-chemical equivalent, *i. e.*, the work done by the passage of one coulomb. We can, therefore, substitute dE for dW and we have by substituting dE in (2)

(3) $$q = T\frac{dE}{dT}$$

and, therefore,

(4) $$E = Q + T\frac{dE}{dT}$$

$$\frac{dE}{dT}$$

is the temperature coefficient, and it follows that if the E.M.F. of a cell increases with temperature

$$T\frac{dE}{dT}$$

is positive, and the E.M.F. is larger than the value calculated from the heat of transformation, and heat is absorbed in the cell; whereas, if the E.M.F. decreases with temperature, the E.M.F. is smaller than the value Q expressed in electrical units. Heat is evolved in the interior of the cell. Now, in some primary cells the temperature coefficient is so small that it can be practically neglected; in others it is so great that the E.M.F. as calculated from the heat of formation will give a decidedly wrong value. With a reaction that is so different from those utilized in ordinary cells, and concerning which we know so little as the one utilized by Dr. Borchers, it is not legitimate to form any conclusions as to the E. M. F. obtainable.

The question now presents itself, what is then the maximum E.M.F. we can expect to gain from the combination of carbon monoxide with oxygen? Is there any reversible transformation, no matter into what kind of energy, about which we do know something? There *is* such an ideal process, and I will show the reasoning by which we can arrive at the desired value. The reasoning is based on the principle of the dynamical equilibrium of chemical systems, which principle is nothing else than a disguised form of the second law of thermo-dynamics. When carbon monoxide combines with oxygen, not all of it is thus oxidized, and at a definite temperature and pressure the composition of the resultant mixture of gases, consisting of CO_2, CO and O_2, is definite. Deville found experimentally that at a temperature of 3,000° Celsius 40 per cent. of the carbonic acid is dissociated at atmospheric pressure. I have calculated from this fact that at a temperature of 0° Celsius and atmospheric pressure, the fraction of dissociated CO_2 is

$$\frac{1 \cdot 58}{10^{34 \cdot 86}}$$

If we conduct the process of combination of CO and O in such a manner that the maximum amount is being obtained, and take care that the temperature does not change, then this work depends on the initial and final condition of the gases. Now, let us suppose 2 gram molecules of carbon monoxide *i. e.*, 56 grams at atmospheric pressure, react on 1 gram molecule, *i. e.*, 32 grams of oxygen, also at atmospheric pressure, in a reversible manner, and that the carbonic acid formed is likewise brought to atmospheric pressure. Then evidently since, as we have seen the dissociation of the carbonic acid is extremely small, the partial pressure of the carbonic monoxide in the product of the reaction must also be very small, and the carbon monoxide, while performing work, has been brought from the atmospheric pressure to an exceedingly small pressure. Now, if the partial pressure of the CO be p_1 then the work done is

$$W = 2\ RT\ log._e \frac{1}{p_1},$$

* Read at the stated meeting of the Electrical Section, Franklin Institute, Philadelphia, March 26, 1895.

where R is the gas constant referring to 1 gram molecule of gas, and is equal to 1·98 calories. The oxygen is similarly brought from the atmospheric pressure to a partial pressure, which is one-half of the partial pressure of the carbonic oxide; for the gases being present in the ratios in which they react on each other, two volumes of CO are present to one molecule of oxygen, and the pressure of the carbonic oxide is twice that of the oxygen. Hence, the work performed by the oxygen is

$$RT \log_e \frac{2}{p_1}.$$

Since the carbonic acid in the reaction mixture is practically under atmospheric pressure, no work appreciably is done upon it, and the total energy obtained by the reversible combination of the two molecules of CO with 1 gram molecule of oxygen is

$$W = 2\,RT \log_e \frac{1}{p_1} + RT \log_e \frac{2}{p_1}$$

$$(5) \qquad W = RT \log_e \frac{2}{p_1^3}.$$

Since now the fraction of the CO_2 that is dissociated at 0° Celsius is

$$\frac{1.58}{10^{34.86}}$$

it follows that the partial pressure p of the CO is

$$\frac{1.58}{10^{34.86}}$$

atmospheres. Substituting this value in equation (5) we have

$$W = RT \log_e \frac{10^{104.58}}{2}.$$

This energy refers to the chemical combination of 2 gram molecules, and is expressed in calories. To obtain the energy for the combination of one electro-chemical equivalent, expressed in electrical units, we divide by 4×23039, and we have

$$E = \frac{1.98 \times 273}{4 \times 23039} \log_e \frac{10^{104.58}}{2} \text{ volts.}$$

$$E = 1.41 \text{ volts.}$$

This is the value for 0° Celsius. The heat of formation of carbonic acid is 68000, and the E.M.F. calculated from this is 1.476. Therefore, by the equation of V. Helmholtz,

$$1.41 = 1.476 + 273 \frac{dE}{dT}$$

$$\frac{dE}{dT} = -\frac{0.066}{273}.$$

The E.M.F. therefore decreases by

$$\frac{0.066}{273}$$

volts, with every increase of temperature by 1°. At the standard temperature, 18° Celsius, the E.M.F. is, therefore,

$$1.476 - 291 \frac{0.066}{273}$$

$$1.476 - 0.07 = 1.406.$$

We thus see that the E.M.F. is somewhat smaller than assumed by Dr. Borchers. The greatest E.M.F. obtained by Dr. Borchers was 0.5 volts. The conclusion which he now draws from this result is that he has already succeeded in obtaining about 30 per cent. of the energy of the coal, whereas, the steam-engine converted much less. This is another non-admissible conclusion. For, in an unpolarizable, *i. e.*, reversible cell, the maximum E.M.F. is a definite value, and if another value is experimentally observed which very appreciably differs from it, then, barring secondary actions, the reaction which is expected to furnish the electric energy does *not* occur. To say that secondary actions depress the theoretical E.M.F. is not logical in this case, for evidently, this secondary E.M.F. would have to be about twice as great as the observed E.M.F., and, therefore, could not be called secondary.

The action that took place in Dr. Borchers' apparatus is most probably one that can be found among those which were investigated and published by Mr. Mond (see London *Electrician*, January 11th, and *Digest Electrical World*, New York, February 2d). It would lead too far to discuss in detail the work of Mond, and to single out the particular action to which the E.M.F. of the apparatus of Dr. Borchers was due.

For reasons which were well stated by the latter, it is more expedient and apparently easier to utilize the combination of carbon monoxide with oxygen for the generation of electric energy instead of that of carbon with oxygen. The work done by Dr. Borchers, though not crowned with success as yet, is nevertheless of high value on account of its instructiveness. It indicates in its general features the path that has to be followed for accomplishing a most important industrial task, the fulfilment of which we hope this century will yet witness.

MUNICIPAL OWNERSHIP OF PUBLIC CORPORATIONS.

BY M. J. FRANCISCO.

It is only necessary to give the experience of cities which have tried the experiment to show the worthlessness of the claim that municipalities can produce light at less expense than private corporations. As an illustration of this, I will refer to Wheeling, W. Va., which recently installed a plant of 400 arc lights to burn all night, using steam power, coal costing $1.00 per ton. Before this municipal plant was established, the local company offered to furnish any number of lights that might be desired, to burn every night and all night, for $72.52 per lamp per year. Parties in Wheeling who had political aspirations made the claim that a plant could be installed for $26,000. This was afterwards raised to $40,000 and again to $60,000, while the actual cost proved to be $125,000. The advocates of municipal ownership represented to the tax-payers that the total cost of running four hundred arc lights, if the city owned the plant, would not exceed $14,000 per year, being $35 per lamp. They adopted the plan, and bonded for $80,000 at six per cent. interest, besides using $22,233 of the gas works' funds (owned by the city) in installing the plant. The principal was payable at the rate of $8,000 per year. Six dynamos were installed with five circuits, one dynamo to be kept as a spare machine. Soon after starting, the armatures began to burn out; lamps were taken off in the hope of relieving the dynamos, thereby stopping the heavy loss; but this did not answer the purpose. In 1894 it became necessary to buy another dynamo and cut down the number of lamps on each circuit, making six instead of five. The city clerk, on page 4, reports the cost of maintaining lights one year at $30,142.42. This does not include interest, depreciation, taxes, insurance, or water rent During 1893 the funds of the gas trustees were exhausted; a coal bill amounting to $15,659.15 could not be paid, as the city authorities had been allowed to use $22,233 of the funds in constructing the electric light plant. In view of the city's heavy indebtedness, and the fact that its finances

* From *Engineering Magazine*, April, 1895.

were so low that it could not pay the interest or the $8,000 of principal on bonds which were due, the bondholders agreed to extend the payment of interest and bonds another year. The fallacy of the claim made by the advocates of municipal ownership that the entire cost of running the plant for a year would not exceed $14,000 is shown by the actual experience for a year, during which time the pay-roll alone amounted to $17,191. The tax-payers have learned the truth regarding municipal ownership and there is trouble; the constant refrain heard now is the "electric elephant on their hands." This is one illustration of the results produced by adopting the unreliable reports and figures used by the advocates of municipal ownership. Experience is a very good teacher, but sometimes rather expensive; and, when the authorities found that it was costing them $112.73 per lamp per year for the same light that the local company offered to furnish for $72.52, they no doubt would have cheerfully dumped the parties whose advice they had followed into one of their huge political machines to see if it would increase the number of amperes required and decrease the steady loss.

The time for municipalities to own and conduct commercial industries has not arrived, and will not arrive until men are born into a world where politicians and aldermen protect tax-payers and refuse "boodle"; when children are removed from parental influence and nurtured by the State, as advocated by Plato; when employés with no interest in the business except to aid the political bosses and draw their salaries, can conduct the business more economically and successfully than men who have perhaps every dollar of their fortune depending upon its success; when, in fact, the millennium arrives and the whole human family is transferred to some eternal city lying beyond the misty shore of time. Until that time comes, let all cities confine their business to regulating and governing, leaving commercial industries with their hazards and losses to individuals and private corporations.

Telephone Notes.

The Harrison Telephone Construction Co., Louisville, Ky., by G. A. Dole, of Minneapolis, Minn., J. C. Strother, F. H. Barney, H. K. Cole and D. M. Goodwin. Capital stock, $100,000.

A telephone system has been organized in Rome, Ga.; J. W. Dodds, of Cedartown, and G. G. Leake, of Marietta, are interested in the project.

A new telephone company is being organized in Savannah, Ga. Over 300 subscribers have already been secured.

The Monroe Telephone Co., Monroe, La., will establish a telephone exchange. W. B. Reily is president.

The East Tennesse Telephone Co., Chattanooga, Tenn., contemplates the extension of its lines to Jasper and other places.

The People's Telephone & Telegraph Co., Knoxville, Tenn., is trying to secure a franchise. Mr. J. C. Duncan is general manager.

The Warren Land & Lumber Co., Warren, Tex., will build a fifteen-miles telephone line to its logging camp.

The Woodbridge & Occaquan Telephone Co. has obtained a franchise and will establish a system in Fredericksburg, Va.

Telephone Patents Issued March 26, 1895.

Telephone System. John I. Sabin and Wm. Hampton, San Francisco, Cal. (No. 536,233.)

Telephone Exchange System. Silas W. Holman, Boston, Mass. (No. 536,382.)

Telephone. Jonathan D. Price, Chicago, Ill. (No. 536,481.)

New Corporations.

The Dover Electric Light and Power Company, Dover, N. Y. Capital stock, $10,000.

The Plymouth County Railway Company, East Weymouth, Mass., by John F. Simmons, president, and Chas. H. Killam, clerk and treasurer. Capital stock, $250,000.

The Forest City Car Manufacturing Company, Harrisburg, Pa. Capital stock, $20,000.

The Market Street, Richmond and Frankford Electric Railroad Company, Philadelphia, Pa.

The Lock Haven Traction Company, Lock Haven, Pa., by Chas. A. Bragg, M. J. Mitchell and Geo. Breed, of Philadelphia. Capital stock, $10,000.

The Stoughton and Canton Street Railway Company, Stoughton, Mass. Capital stock, $12,000.

The Metropolitan Electric Company, Chicago, is finding very ready sales for its new carbon open-circuit battery that it recently put on the market.

The St. Louis Light & Power Company has made application for permission to construct subways in certain streets in that city.

The Charlotte *Observer*, Charlotte, N. C., will instal an electric light plant in its building.

The Simplex Electrical Co., Boston, Mass., by Charles A. Morss, president; C. A. Morss, jr., treasurer and H. A. Morss. Capital stock, $150,000.

The Multiphase Motor Co., New York, N. Y., by Alfred S. Brown, Geo, W. Gardanier and Watson D. Schram. Capital stock, $200,000.

The Hinton Telephone Co., Hinton, W. Va., by J. T. McCreery, Harvey Ewart, P. K. Litsinger and others, to establish a telephone system.

The Saranac Lake Electric Light Co., Saranac Lake, N. Y., by Orlando Blood, Wallace Murray and others. Capital stock, $30,000.

The Union Telephone Co., Union, S. C., by W. D. Arthur, president and treasurer, P. H. Oetzel, W. T. Thompson, W. W. Nicholson and others. Capital stock, $1,000.

The Newton, Langhorn & Bristol Electric Street Railroad Company, Harrisburg, Pa., by Henry W. Wharton, its president. Capital stock, $60,000.

The Berwyn & Devon Passenger Railway Co., Harrisburg, Pa., by Geo. Roney, president. Capital stock, $18,000.

Possible Contracts.

The Pioneer Mills which were recently destroyed by fire in Burlington, Vt., are to be rebuilt. E. J. Booth is manager.

It is proposed to establish a municipal electric light plant in Winchester, Mass. The town clerk can give further information.

A municipal electric light plant is contemplated in Norwich, Conn. For further particulars address the Mayor, C. A. Harwood.

The Middletown Traction Co., Middletown, N. Y., contemplates the extension of its lines to Bloomington, N. Y.

The Mohawk, Herkimer and Ilion Street Railway Co., Mohawk, N. Y., has decided to equip its lines with electricity.

It is reported that a new electric railway is to be built between Dover and Milford, Delaware. The clerk of the City Council can give further information.

Bids will be received until April 28 for lighting Greensboro, N. C. Address A. M. Scales, city clerk.

An electric light plant will probably be established in Blackstone, R. I.

It is reported that a trolley line will be built from Port Jefferson to Patchogue, L. I. O. T. Fanning, of Port Jefferson, is interested in the project.

The clerk of the City Council, Toledo, Ohio, can give information regarding the project to build an electric railway from that city into Williams county.

The citizens of Carbondale, Pa., are about to organize a company for the establishment of a telephone exchange. Parties who are prepared to furnish a complete and reliable system can obtain further information upon application to A. P. Trautwein, secretary of the Board of Trade.

The Home Telephone Company, of Chillicothe, Ohio, has over two hundred subscribers pledged, and is now in the market for the best non-infringing telephone, and exchange equipment.

It is proposed to build an electric light plant for the village of Charlotte, N. Y. Edward Harris, 15 Rochester Savings Bank Building, Rochester, N. Y., can give further particulars.

Bids will be received until April 17 for a complete electric light and power plant in Willoughby, Ohio. Address C. C. Jenkins, clerk, for further particulars.

The New England Telephone Co., Worcester, Mass., will construct a new building.

An election is to be held in Evanston, Ill., on April 16, to vote on the question of issuing $30,000 bonds for the construction of an electric light plant.

Address H. L. Page, Norfolk & Ocean View Railroad Co., Norfolk, Va., for particulars regarding the new electric plant to be built for that company.

The Portsmouth Street Railway Co., Portsmouth, Va., will build a new power station.

The East Alabama Land Co., Atlanta, Ga., will build a large hotel at the exposition grounds. The plans have been prepared by Frederic Ausfield.

It is reported that Mr. H. M. Flagler will build a large hotel at Biscayne Bay, Fla.

The General Electric Co. has secured the contract for changing the Independence Steam Dummy line to electricity, Kansas City, Mo.

Loss & Co., New Orleans, La., have received the contract for rolling stock and rails for the Orleans Railroad Company.

An electric light plant is to be built in the city of Versailles, Ky. For further particulars address the Mayor.

The Tallahassee Shoals Electric Co., Athens, Ga. Capital stock, $50,000.

The plans prepared by Mr. H. M. Atkinson, Atlanta, Ga., for supplying electric lights and electric power for the exposition grounds in that city, have been approved. The plant will have 1,000 electrical horse-power, with 500 arc lights and 10,000 incandescents.

An election is to be held in Humboldt, Tenn., on the question of issuing bonds for a water-works and electric lighting system. J. C. Crew is Mayor of that place and may be addressed for further particulars.

The Kaufman Mfg. Co., Kaufman, Tex., will install an electric light plant in its wooden-ware factory.

The Midland Road, Edgewater, S. I., N. Y., has asked permission to convert its Stapleton branch into an electric line. The board of trustees can be addressed.

The electric light plant owned by the Bloomington Electric Light and Power Company, Bloomington, Ill., which was destroyed by fire recently, is to be rebuilt in the near future.

The erection of a municipal electric lighting plant is contemplated in Arlington, Mass. E. Delmont Locke is interested.

The Globe Electric Light Company, Roxbury, Mass., has purchased a site on which they contemplate building a plant. Address the secretary.

The residents of Port Huron, Mich., will vote, April 1, on the question of issuing $30,000 worth of bonds for the construction of an electric lighting plant.

Three hundred thousand dollars worth of bonds are to be issued for the purpose of converting the New Orleans Railroad, New Orleans, La., into an electric system. Peter Couget, La Harpe and White streets, is president of the company.

A bill has been introduced authorizing the construction and maintenance of a municipal electric lighting plant in Trenton, N. J. The city clerk can be addressed for particulars.

The Globe Street Railway Company, Fall River, Mass., has petitioned for a franchise to equip and operate an underground system of electrical feed wires. F. S. Stevens, president of the company, can be addressed for details. The Fall River Electric Light Company has also petitioned for permission to lay its wires underground. The secretary can be addressed.

The council, Jamestown, N. Y., has been required to extend the electric lighting system on several streets. The clerk of the council can be addressed.

The Cohoes City Railway Company, Cohoes, N. Y., will establish a power-house on the Erie canal. The secretary of the company can be addressed.

Sealed proposals will be received until April 8 for the electrical work for the Fifth avenue high school building, Pittsburgh, Pa , after plans prepared by E. Stotz, 101 Fifth avenue. Charles Reisfer, secretary of the Board of Education, can be addressed.

The residents of Tamaqua, Pa., are contemplating the erection of an electric lighting plant. The clerk of the council can be addressed for further information.

An ordinance has been passed authorizing the issuance of bonds by the Goffstown Fire Precinct for an electric light plant in Goffstown, N. H. For details address the clerk of the council.

Sealed proposals will be received until April 8 by the Board of Trustees, Chatham, N. Y., for lighting the streets of the village for a period of five years. Eighty-five incandescent lights will be required. W. B. Daley, village clerk, can furnish details.

The question of building a trolley line through Medford, N. J., is being agitated. The town clerk can be addressed.

The Hartford Street Railway Co., Hartford, Conn., has asked for permission to run its line from Wethersfield avenue station to the city hall. General Manager Crawford can be addressed. The Central Railway and Electric Co. has applied for permission to extend its lines through certain streets of the city. The secretary of the company can be addressed.

The Rochester, Charlotte and Manitou Railroad Co., Rochester, N. Y., has purchased the old Grand View Beach Railroad, which they will improve and operate. The capital stock is $100,000. Michael Doyle and Valentine Fleckenstein are among the directors and can be addressed for further particulars.

The Taunton and Fall River Street Railway Company has been granted a franchise by the selectmen for a line to be built at Somerset, Mass. The secretary can furnish details.

An electric railroad is projected between Lawrenceville, Pa., Bloomfield, etc. Address the clerk of the council for details.

We are informed that the Cumberland Valley Traction Company, Fairview, Pa., will extend the road up the river to Marysville. The secretary of the company can furnish details.

We are informed that an isolated electric plant is to be installed in the new court house, Rochester, N. Y.

THE ELECTRIC CONSTRUCTION AND SUPPLY COMPANY.

In the article in our last issue regarding the new Electric Construction and Supply Co., the statement that the old concern by that name had been reorganized was an error. The object of the new company was to resume the business of the old one; further than that there is no relation between the two. The article having been based on this misstatement of fact, other misleading statements unfortunately crept in as a result.

Every one who ever had any dealings with the old company knows that the management enjoyed the full confidence of the trade, and it was furthest from our thoughts to cast any reflection upon it, individually or collectively. We take pleasure in correcting these statements which are liable to mislead the average reader, although to those who are familiar with the facts and individuals in the case an explanation is hardly necessary, because of the high reputation and integrity of the persons concerned.

New York Notes.

Office of the Electrical Age,
World Building, New York,
April 1, 1895.

Mr. A. M. Johnston, the well-known elevator man, is now connected with the Moore & Wyman Elevator and Machine Works, 126 Liberty street, New York.

The Electrical and Mechanical Engineering and Trading Company, 39 Cortlandt street, New York City, has abbreviated its name somewhat. It is now known as the Electrical and Mechanical Engineering Company. Mr. J. H. Vail is president and chief engineer of the company.

At a meeting of the stockholders of the Postal Telegraph Company, on March 28, an increase of capital stock from $10,000,000 to $15,000,000 was authorized. The additional $5,000,000 is to be used in paying for extending the company's lines.

The artistic brackets used in connection with the new system of lighting the Brooklyn Bridge cars by electricity were made from the designs of the Woods Combination of the Wallace Electric Co., Chicago. These brackets support the conductor over the car roofs, connection with the cars being effected by means of a short trolley arm.

The New York post-office is being equipped with interior telephones. The object is to bring the heads of the various departments into immediate and direct communication with the postmaster's office. The main switchboard is the one that was used at the World's Fair. It has fifty drops. In conjunction with the telephone a speaking-tube system will be operated.

Mr. Geo. B. Mallory, 106 Produce Exchange, City, who is one of the electricians of the early days of electric lighting, is giving his attention and time to the designing of buildings for electric lighting, etc. Mr. Mallory makes a specialty of electrical transmission of power. In 1879 he was connected with the Edison Electric Co. as naval engineer, and has since become an expert naval architect.

The National Leather Belting Co., No. 7 Ferry street, New York, was established about two months ago by its manager, Mr. Henry Loeb. The factory is large and equipped with the latest machinery for the manufacture of this class of goods. The company makes a specialty of electric light belting. The leather used in the belts is pure oak tanned, and the belting is well and favorably known among electric light companies. Mr. Loeb has sold belting to the largest electric and other companies.

The Mutual Automatic Telephone Company has been formed in this city, with a capital stock of $6,000,000, to do business in New York city, Brooklyn and vicinity. The offices of the new company are in the Mills building, Broad street, and the officers are: J. Wesley Allison, president; Silas B. Dutcher, first vice-president; John C. McGuire, second vice-president; H. N. Whitney, treasurer; A. B. Macklin, secretary. It is stated that the company has already 1,000 contracts for instruments in Brooklyn alone. The Mutual Automatic Telephone Company is a branch of the State company known as the Automatic Telephone and Electric Company, which controls the rights in this State of the Strowger Automatic Telephone Exchange.

W. T. H.

Trade Notes.

Morris & MacCurdy, 94 & 96 W. Meridian steet, Indianapolis, Ind., have in their Phœnix rubber insulating paint just what the electric trade has been wanting. It is the only fire-proof insulating paint and is for dynamo, field and armature coils. It is also valuable for station insulating work. These two qualities in one substance is something rare and valuable. This firm is the sole manufacturer of this paint. The Phœnix paint is meeting with flattering results among users, and Morris & MacCurdy are receiving many testimonials. They have just completed a large warehouse for manufacturing and carrying a stock, and are now prepared to make shipments from 5 gallons to a car load on twenty-four hours notice.

The F. D. Potter Co., 39 & 41 Cortlandt street, New York, agents for the Straight Line engine, has issued a neat folder giving a list of installations in New York city of these well-known engines. They are found in office buildings, apartment buildings and residences, steamers, ferry boats, club houses and theatres, breweries, etc.

Mr. F. M. Hawkins, manager of the New York office of the Electric Engineering and Supply Co., of Syracuse, N. Y., has lately closed some fine orders for incandescent supplies. They include a red Tennessee marble switchboard for Doelger's brewery. It is 6 x 8 feet, and will have eighteen switches ranging from 25 to 500 amperes; four Weston voltmeters and ammeters; two Carpenter rheostats and two sets of bus bars. The rheostats will be mounted at the back of the board with his company's new rheostat dial on the face. The board is on exhibition at his office, 136 Liberty street. It was exhibited at the Cleveland convention and greatly admired.

The flexible conduit, made by the American Circular Loom Company, Boston, Mass., is rapidly growing in favor. It is spoken of very highly by those who are using it. A testimonial circular issued by the company gives a long list of buildings installed with flexible conduit.

B. W. Payne & Sons, 41 Dey street, New York, have just closed a contract with the Corning Electric Railway Company, Corning, N. Y., for a complete steam plant for its power-house. There will be two centre crank compound engines of 250 h.p., connected direct to Walker Manufacturing Company's generators, and two 150-h.p. boilers. There will also be a 150-h.p. centre-crank, high-speed engine, belted to Ball arc and Walker incandescent dynamos.

WOVEN WIRE BRUSHES.

The Belknap Motor Co., of Portland, Maine, are the patentees and manufacturers of the best woven wire commutator brush on the market.

Electrical and Street Railway Patents.

Issued March 26, 1895.

536,210. Electrical Signaling Apparatus. William E. M. Jackson, San Francisco, Cal. Filed June 8, 1893.

536,221. Electric Switch. Charles J. Miller, Philadelphia, Pa. Filed Jan. 19, 1895.

536,226. Magnetic Separator. James D. McKinnon, Portland, Ore. Filed Aug. 7, 1894.

536,233. Telephone System. John I. Sabin and William Hampton, San Francisco, Cal. Filed Nov. 9, 1894

536,235. Car-Fender. Mahlon M. Scott, Newark, N. J., assignor of one-half to Elvin W. Crane, same place. Filed Jan. 26, 1894.

536,250. Adjustable Switch for Trolley Systems. Montraville M. Wood, Chicago, Ill. Filed July 14, 1894.

536,256. Electric Railway Switch. Rollin A. Baldwin, South Norwalk, Conn., assignor to the Fitch-Excelsior Switch Company, of New Jersey. Filed Oct. 24, 1893.

536,266. Electric Switch. Cummings C. Chesney, Pittsfield, Mass., assignor to the Stanley Laboratory Company, same place. Filed Jan. 17, 1895.

536,271. Electrical Signal and Switch-Operating Apparatus. Justin Dutrey, New Orleans, La. Filed July 19, 1894.

536,275. Supply System for Electric Railways. Charles E. Emery, Brooklyn, N. Y. Filed March 15, 1894.

536,300. Street-Car Screen-Guard. Edward W. Selkirk, Chicago, Ill. Filed May 31, 1894.

536,311. Fusible Cut-Out. James J. Wood, Fort Wayne, Ind. Filed Dec. 27, 1894.

536,319. Method of Insulating High-Tension Coils of Transformers. August Schneller, Aarlanderveen-Alfen, and William J. Wisse, Haarlem, assignors to Henry Tindal, Amsterdam, Netherlands. Filed Dec. 27, 1894. Patented in France January 22, 1894, No. 235,686; in Switzerland January 27, 1894, No. 8,113; Belgium Jan. 27, 1894. No. 108,300; in Luxemburg Jan. 29, 1894, No. 1,967; in Sweden Feb. 8, 1894, No. 5,400; in Italy Feb. 9, 1894, No. 35,719; in Austria Feb. 10, 1894, XLIV, No. 76; in Hungary Feb. 16, 1894, No. 55; in Spain March 1, 1894, No. 15,427, and in England March 17, 1894, No. 5,647.

536,328. Snow-Plow for Street Railways. Francis W. Dean, Cambridge, and William E. Mathews, Boston, assignors to the Taunton Locomotive Manufacturing Company, Taunton, Mass. Filed Feb. 1, 1895.

536,329. Cable Car Brake. Jean B. Z. Dumais, Chicago, Ill., assignor of one-half to Charles Bachrach, same place. Filed Jan. 24, 1895.

536,374. Conduit Electric Railway. Frederick S. Davenport, Jerseyville, Ill. Filed Jan. 28, 1895.

536,382. Telephone Exchange System. Silas W. Holman, Boston, Mass. Filed March 24, 1894.

536,411. Velocipede Provided with Electrical Communicating Apparatus. Raphael H. Wolff, New York, N. Y. Filed Aug. 18, 1894.

536,418. Street-Car Fender. Michael Clooney, St. Louis, Mo., assignor of two-thirds to Robert McCulloch and C. Nesbit Duffy, same place. Filed Dec. 24, 1894.

536,420. Telegraphy. Patrick B. Delany, South Orange, N. J. Filed Nov. 19, 1894.

536,438. Electric Mining Machine. Edmund C. Morgan, Chicago, Ill. Filed July 18, 1894.

536,467. Electric Signal System. Webster Gillette, New York, and Alexander S. Williams, Long Island City, N. Y., said Gillette assignor to said Williams. Filed Oct. 30, 1894.

536,478. Combination Electrical Meter. Herschel C. Parker, Brooklyn, N. Y. Filed Jan. 9, 1895.

536,481. Telephone. Jonathan D. Price, Chicago, Ill. Filed July 30, 1894.

536,518. Car-Fender. Adams Hare, Allegheny, Pa. Filed Aug. 17, 1894.

536,530. Electric Current Regulator. Charles M. Jordan, Washington, D. C. Filed Feb. 13, 1895.

536,535. Electric Brake. Edward D. Lewis, Savona, N. Y. Filed Nov. 12, 1894.

536,539. Car-Truck. William W. McKee, Catasauqua, Pa. Assignor of two-thirds to James W. Fuller and Thos. Bragg, same place. Filed May 25, 1894.

536,547. System of Electrical Signaling for Railways. Charles Selden, Baltimore, Md. Filed Dec. 26, 1894.

REISSUES.

11,481. Closed-Conduit Electric Railway. William Lawrence, New York, N. Y., assignor to the Lawrence Electric Company, same place. Filed March 26, 1894. Original No. 516,631, dated March 13, 1894.

ELECTRICAL AGE

VOL. XV., No. 15 NEW YORK, APRIL 13, 1895. WHOLE No. 413

ESTABLISHED 1883.

Entered at New York P. O. as second-class matter, January 18, 1891.

THE ELECTRICAL AGE PUBLISHING CO., PUBLISHER

TERMS OF SUBSCRIPTION:

One Copy, one year,	$3.00
One Copy, six months,	1.50
Great Britain and other Countries,	4.00

Cable Address (all Cables,) "Electage," New York.

W. T. HUNT, President F. N. BASSETT, Vice-President

T. R. TALTAVALL, Secretary and Editor.

NEWTON HARRISON, E. E., Scientific Editor.

Canadian Representative, E. W. SAYER, Montreal, Que.

ADDRESS ALL COMMUNICATIONS TO

THE ELECTRICAL AGE PUBLISHING COMPANY,

FIRST FLOOR, WORLD BUILDING.

NEW YORK.

NEW YORK, APRIL 13, 1895.

CONTENTS.

ANOTHER FIRE VISITATION.

Within the past month two of the most prominent electrical establishments in the country have suffered serious losses by fire. On March 13 the laboratory of Mr. Nikola Tesla was destroyed by fire, and on April 7 the factory of the Crocker-Wheeler Electric Co. suffered in like manner. The work of fire, however, causes only a temporary stoppage in enterprises of this character, and in each of these two instances the work of re-establishing the normal conditions was begun before the ashes of the ruined buildings had fairly cooled off. The electrical fraternity at large sympathize with the Crocker-Wheeler Company in their loss, as they did with Mr. Tesla when his place was destroyed.

THE BROOKLYN STRIKE—ITS CAUSE.

The special committee of the New York Assembly, appointed to investigate the recent trolley strike in Brooklyn, has made its report. In the opinion of the committee the real cause of the strike was not the failure to agree on the points in dispute between the companies and their employés, but the fact that the men felt that they were unfairly dealt with, "while the corporations themselves were handling their properties for the purpose of stock speculation and for the amassing of fortunes." In order to avoid trouble of this character in the future the committee recommends that some means should be found to compel the employés of railroad companies to give proper notice of intention to leave, as well as to compel the companies themselves to give proper notice of the intention to discharge. Compulsory arbitration the committee thinks is impracticable at this time, in view of the fact that the principle itself involves an infringement of personal liberty. In conclusion, the committee states that the conditions and disorders under consideration grow out of social facts and economic conditions which are too deep for radical cure by legislation. "The only ultimate cure," the report says, "must come naturally from better relations and a greater feeling of sympathy between employers and employed."

CALCIUM CARBIDE.

In this issue we publish two interesting articles, which although under different titles, run along the same lines in part. The production of calcium carbide in the electrical furnace, and the possibility of this substance becoming, as an illuminant, a competitor of electric light, has of late directed considerable attention to the commercial aspect of the subject. Mr. Nelson W. Perry, in an article in the *Engineering Magazine*, refers to the production of calcium carbide as a possible means of overcoming the irregularity of demand for current upon central stations. The day load is a problem that concerns all central station managers, and how to create a demand for current in the daytime so that the generating apparatus can be kept in operation continuously at its most efficient output, is a question that has so far baffled all efforts to find a solution. Mr. Perry advocates the manufacture of a by-product during the time when the demand for current for lighting is at its minimum, and calcium carbide is one of the by-products mentioned. In this reference to calcium carbide he touches the subject of the other article, which appears under the head of "Calcium Carbide." In the latter, Mr. M. P. Wood deals with the manufacture of this product from a commercial standpoint. He gives figures in considerable detail showing the probable cost of producing calcium-carbide, and in summing up his argument he does not seem to hold out any great promise as to profit in its production. It is yet too early, however, to foretell with any accuracy the actual cost of the production of the substance on a commercial scale, although the Electric Gas-Light Company has given out data which purports to be reliable. Mr. Wood takes this data as the basis of his article, and takes a negative view of the situation.

RECEPTION OF THE EDISON ELECTRIC ILLUMINATING CO. OF BROOKLYN.

On April 3, the officers and directors of the Edison Electric Illuminating Company of Brooklyn gave their annual reception and inspection of their new machinery located at their First District Station, Edison Building, Pearl street, Brooklyn.

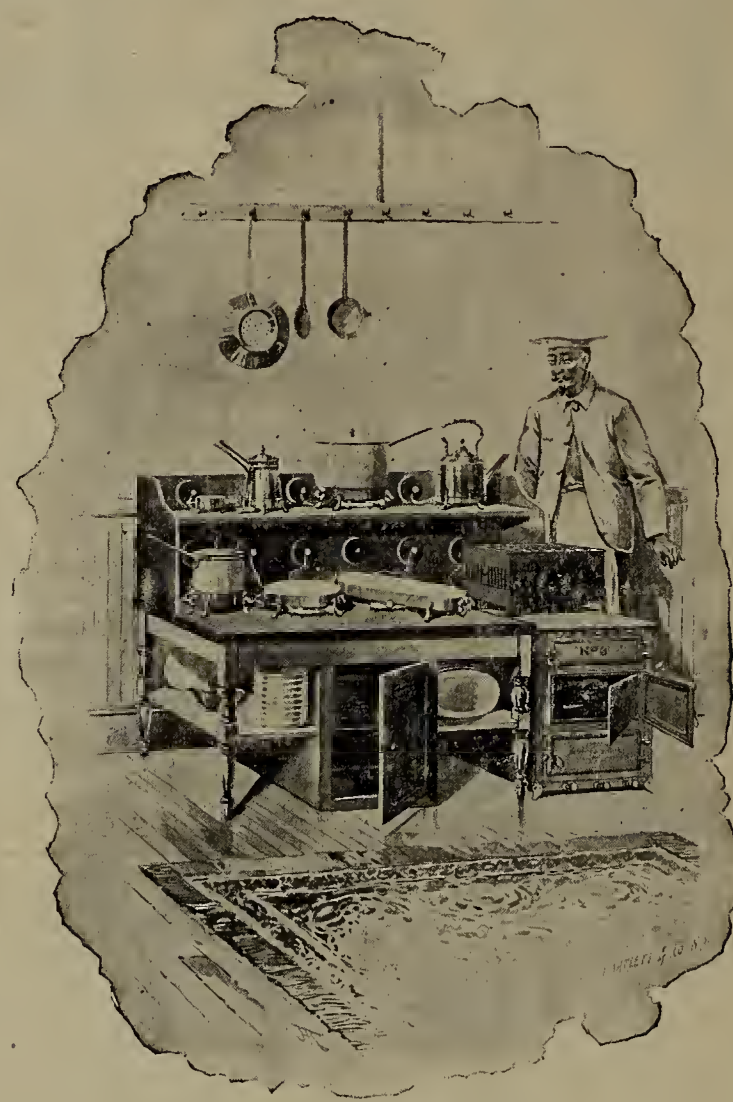
In addition to the new improved machinery which the company has recently installed there were on exhibition numerous devices showing the application of electricity for different purposes.

The new Otis electric elevator conveyed the visitors to the third floor, where electric motors, incandescent lamps of various candle-power and colors and various kinds of electric cooking utensils, made by the Central Electric Heating Co., were exhibiting in operation. Mrs. Lempke practically illustrated the use of different cooking utensels. The accompanying illustrations show some of the cooking utensils used on this occasion. The electrical ovens are made in three sizes, the smallest having a compartment 13 inches wide, 18 inches deep and 9 inches high, and arranged for two different degrees of heat. The largest size has an additional cooking chamber 7 inches high, with one heat. Meats are cooked more evenly and in less time than in the ordinary coal-heated oven. As a bread baker this oven is far superior to the old style. The electric heat is steadier and more effective.

Among the other articles used were chafing dishes, tea-kettle and stand, farina boilers, tea-kettles, portable stoves, broilers, coffee-pots, curling-iron heaters, air heaters, etc., etc.

The lecture room was, on this occasion, given over to exhibits of various kinds. The Quimby hydraulic electric elevator pump attracted a good deal of attention. By this new combination it is possible to operate the present hydraulic elevators by electricity much more economically than by the use of a steam pump.

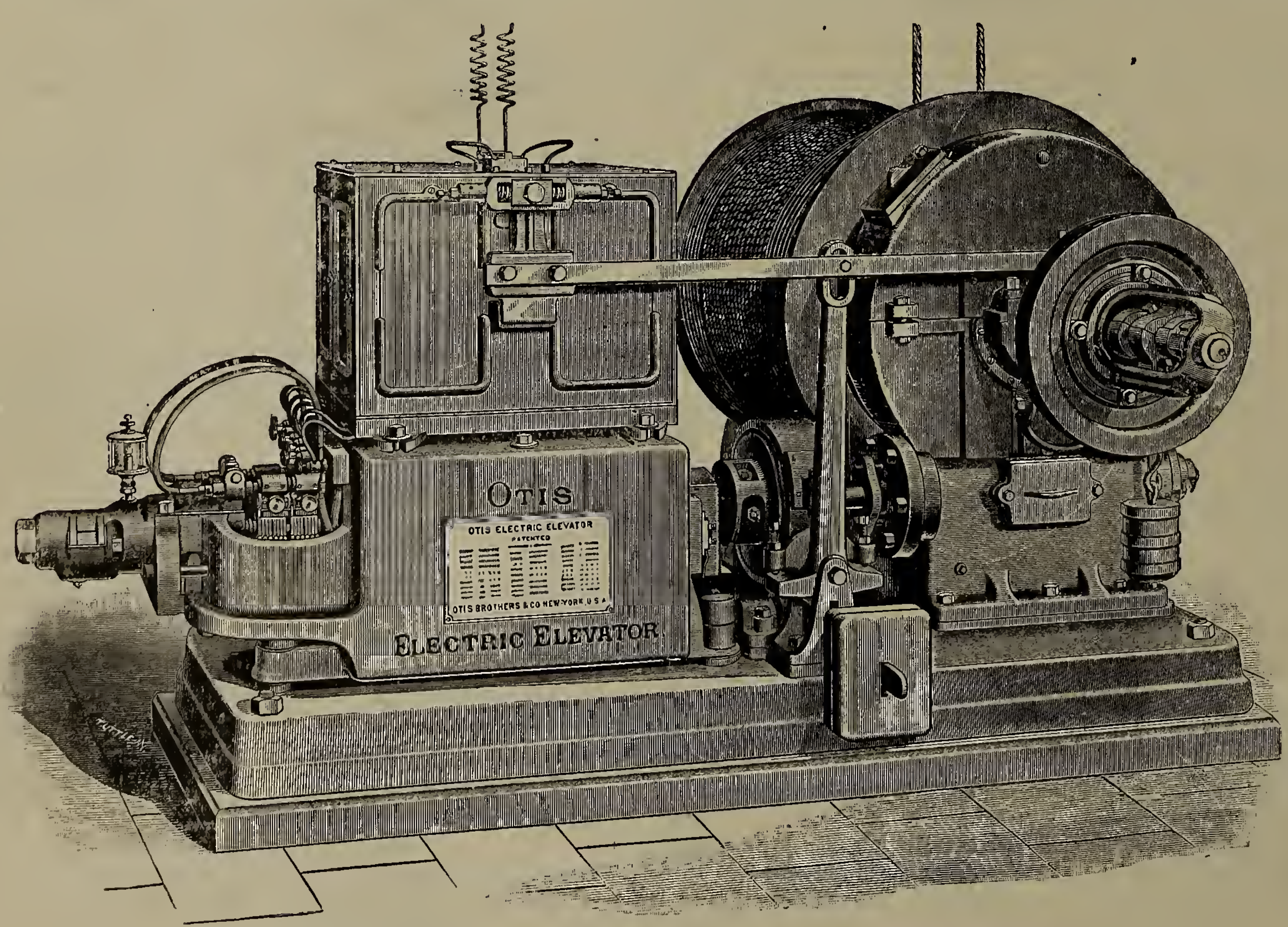
The A. B. See Manufacturing Company had in full operation one of their new direct connected elevator outfits illustrating the simplicity and economy of their apparatus. With the direct-connecting method the elevator consumes energy only when it is in actual operation, and therefore



KITCHEN OF THE FUTURE.

costs the consumer nothing while it is at rest.

Dr. Hutchinson, of the Long Island College Hospital,



OTIS ELECTRIC ELEVATOR.

demonstrated the applicability of Edison current to electro-medical apparatus. He used for the purpose instruments made by J. C. Vetter & Co. and the Monarch Company. By the use of this apparatus it is possible to grade the current to exceeding fineness.

An electric piano played fascinating music. The automatic attachment is made by the Automaton Piano Co. and

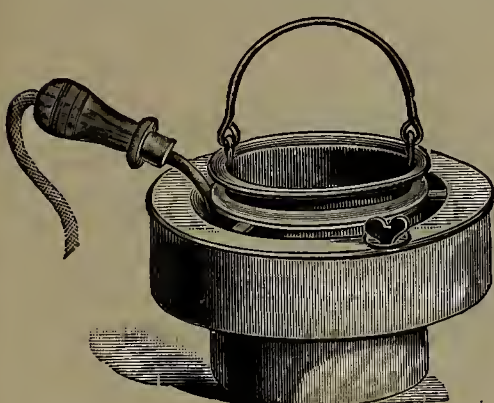
ELECTRIC TEA-KETTLE.

ELECTRIC IRON.

ELECTRIC CHAFING DISH.

can be attached to any piano, rendering it possible to produce music without human aid.

In this room was also shown a white marble switch-



ELECTRIC FARINA KETTLE.

ELECTRIC HEATER.

board made by the Brooklyn Electric Mfg. Co. The board was supported by an iron frame Mounted on it were a Weston voltmeter and ammeter, and a number of the Brooklyn Co's. switches. The board was connected in

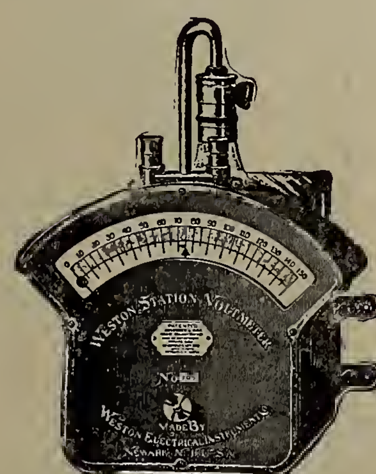
ELECTRIC OVENS.

circuit to show its operation, and it attracted considerable attention.

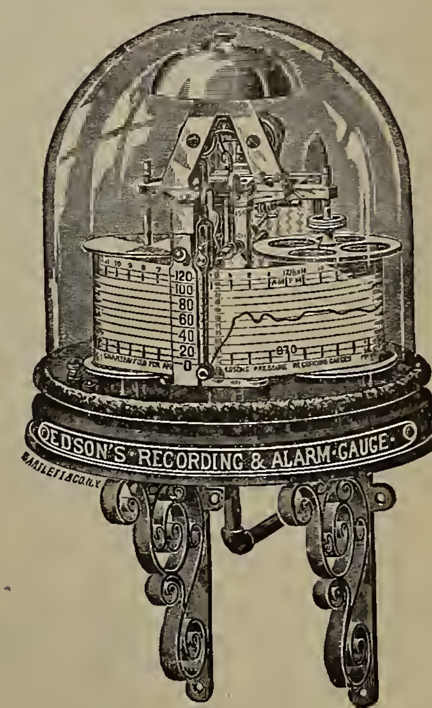
The power room was next visited. The office of the engineer-in-chief, which is located on the gallery, contains an Edson recording gauge, an automatic load indicator and numerous other devices necessary for the successful operation of a large steam plant. The Edson pressure recording gauge insures careful firing, steady steam, and increases the efficiency of any engine or boiler. The instrument shown in the illustration has an adjustable circuit-closer for high pressure, operating an electric bell located on the instrument. These gauges have been in constant and successful operation for more than twenty years, and are giving the best of satisfaction to their users.

The engine room when completed will contain six engines of 1,500 H. P., and four of 750 H. P. each, all running direct-connected dynamos, and will be one of the largest engine rooms in the country. Four of the engines now in servicewere made by the Lake Erie Engineering Co., of Buffalo, N. Y. On the same floor are located two "Boosters," made by the Crescent Electric Co., of Brooklyn, which are used in transmitting current at long distances.

The exhibit of the Edison street arc light system attracted a great deal of attention. It showed the automatic clock



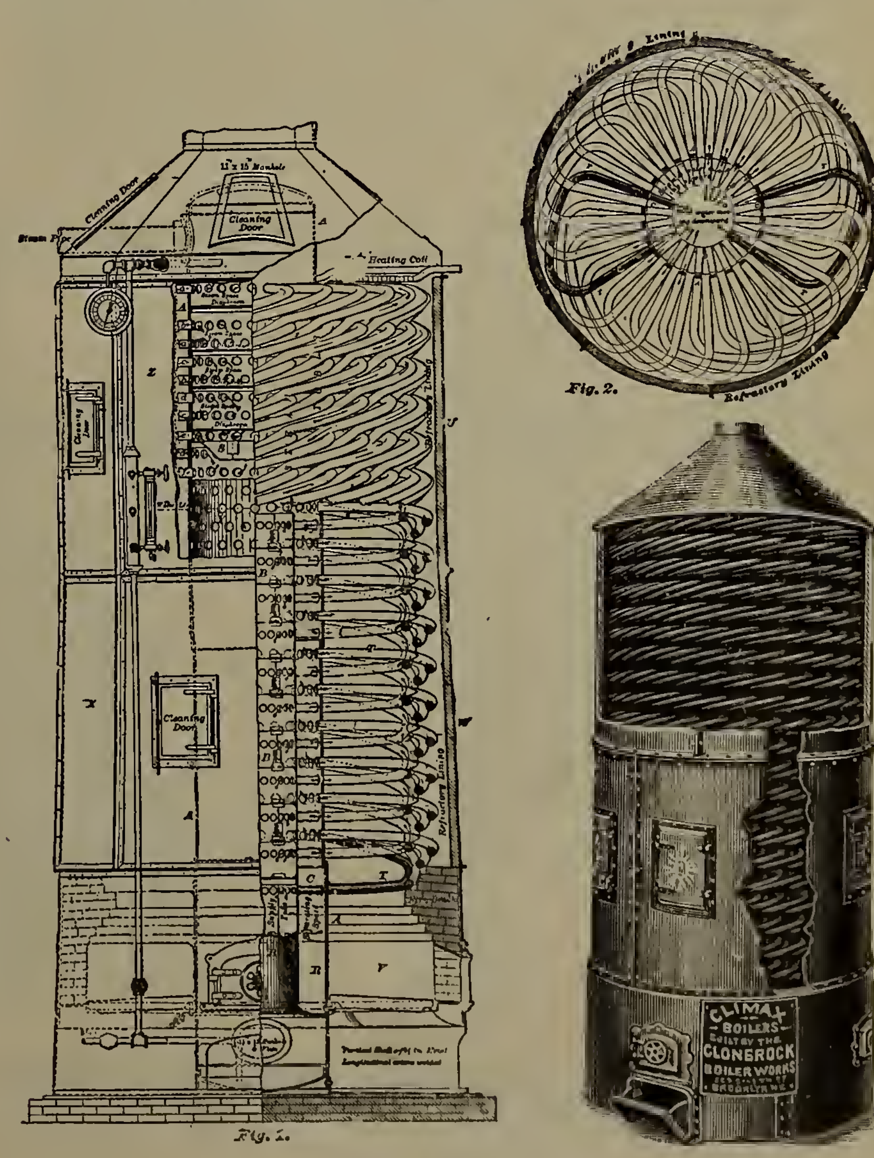
WESTON VOLTMETER.



EDSON RECORDING GAUGE.

switch used for turning on and off the lights, as well as a sample of the underground system to which the pole was connected.

An electric forge made by the U. S. Electric Forge Co., New York, attracted much attention.

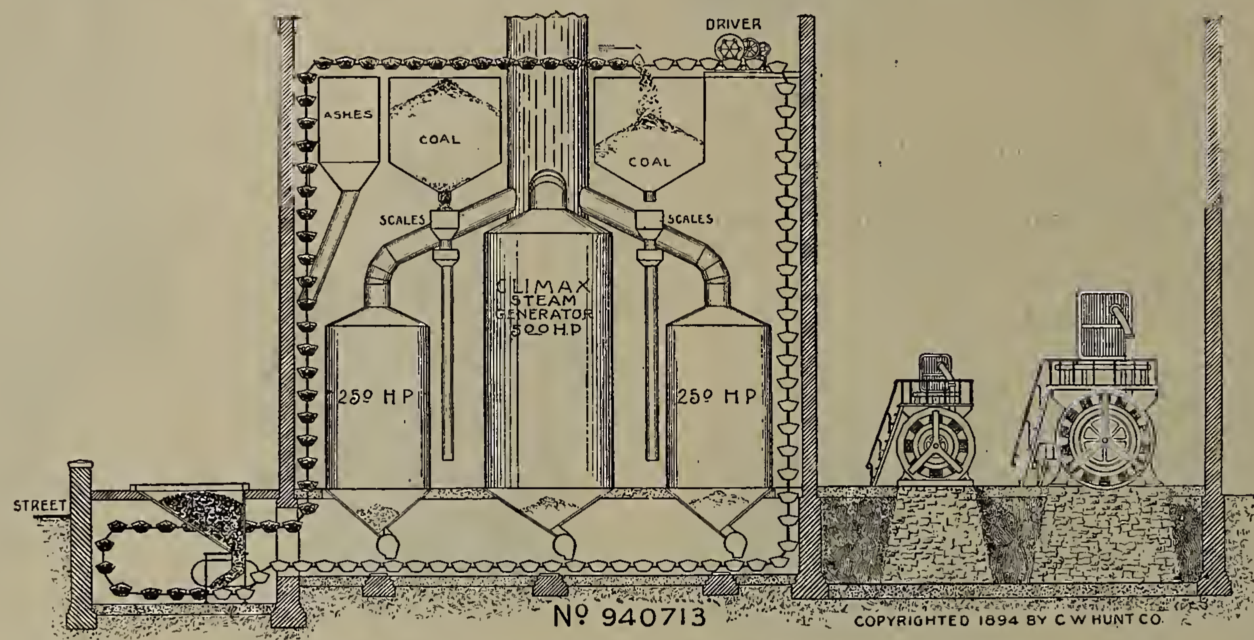


CLIMAX BOILER.

The old engine room is being remodelled to make way for eight 600 H. P. climax boilers, which will be used for supplying the power for the new engines. With the new

improvements, the total boiler capacity of the station will be 4,000 H. P. nominal, and 4,500 H. P. engine capacity. The remodelled plant will be entirely of Climax boilers. In the first district station of the Edison Illuminating Co., a 600 H. P. Climax boiler has been installed, which is generating at the present time 800 H. P. This boiler occupies a space of only 14 feet in diameter, and 29 feet high. Climax boilers evaporate 11 lbs. of water for every pound of combustible. Their great economy of fuel has created such a demand for them that the Climax Boiler Co., of Brooklyn, N. Y., the manufacturers, have doubled the capacity of their works in the past six months. Last year over 10,000 H. P. of Climax boilers were installed in coal and ashes in the Edison Illuminating Company's station, by the C. W. Hunt system. The conveyor is carried in partitions built in the brick walls, and runs between the ceiling of the engine-room and the floor of the general offices. It is noiseless in its operation and is out of sight except when passing over the coal storage pockets. The coal is received from wagons, carried up and over the power room and is discharged in the coal storage bins, from which it is drawn through chutes directly to the boiler room floor. One of the illustrations shows the arrangement of the coal handling machinery at the Edison Co.'s Third District Power Station.

The Brooklyn Edison Company is now running 125,000

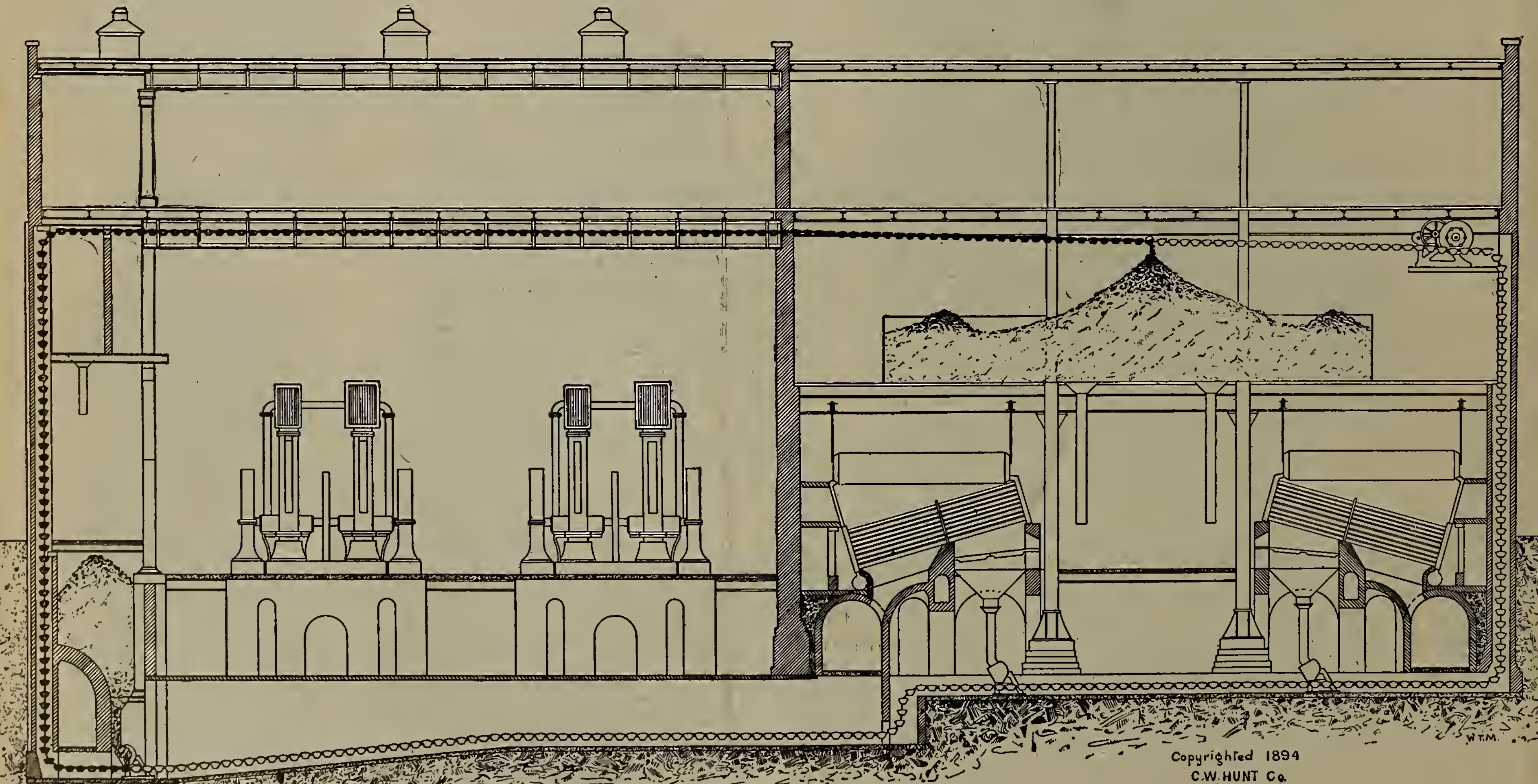


COAL CONVEYORS, THIRD DISTRICT EDISON STATION, BROOKLYN.

electric light and power plants alone. At the Company's Second District Station, at 26 to 30 Lexington avenue, two Climax boilers of 600 H. P. capacity are in operation, and in the Third Station, on Gwinnett street, are three Climax boilers of 1,200 H. P. capacity. The illustrations show sectional views and a perspective view of the Climax boiler.

The C. W. Hunt system of conveyors brings the coal to 16-c. p. lamps from its three stations and 2,000-h. p in electric motors for operating machinery. Crocker-Wheeler, C. & C. and other makes of motors are used, and the demand for these machines is constantly increasing.

In addition to the exhibits above mentioned was a fine one of low-tension arc lamp furnished by the General Incandescent Arc Light Company of New York. It showed a va-

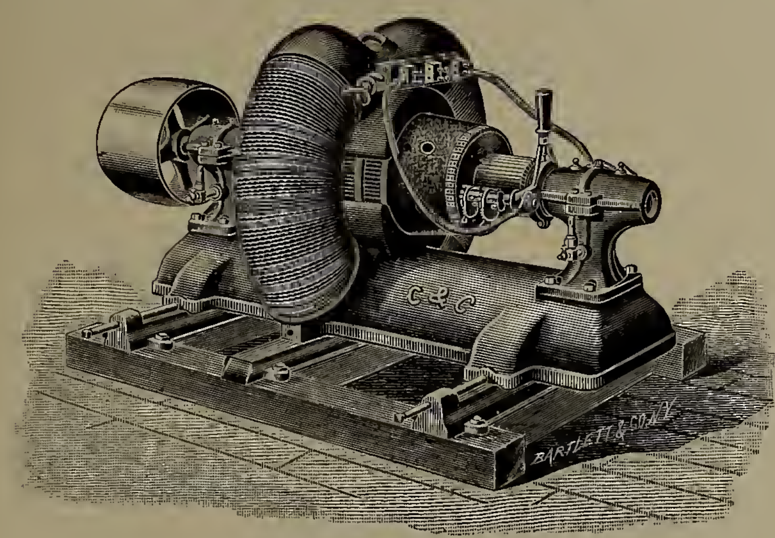


C W. HUNT COAL CONVEYOR SYSTEM, FIRST DISTRICT EDISON STATION, BROOKLYN.

the boilers and removes the ashes. Sixty tons of coal are thus handled per day, without any manual labor. The accompanying illustrations show the method of handling riety of ornamental designs for inside lighting. Mr. R. B. Corey's lamps attracted marked attention by their handsome design and beautiful white and steady light.

The Edison Decorative and Miniature Lamp Department show various styles of small incandescent and candelabra lamps.

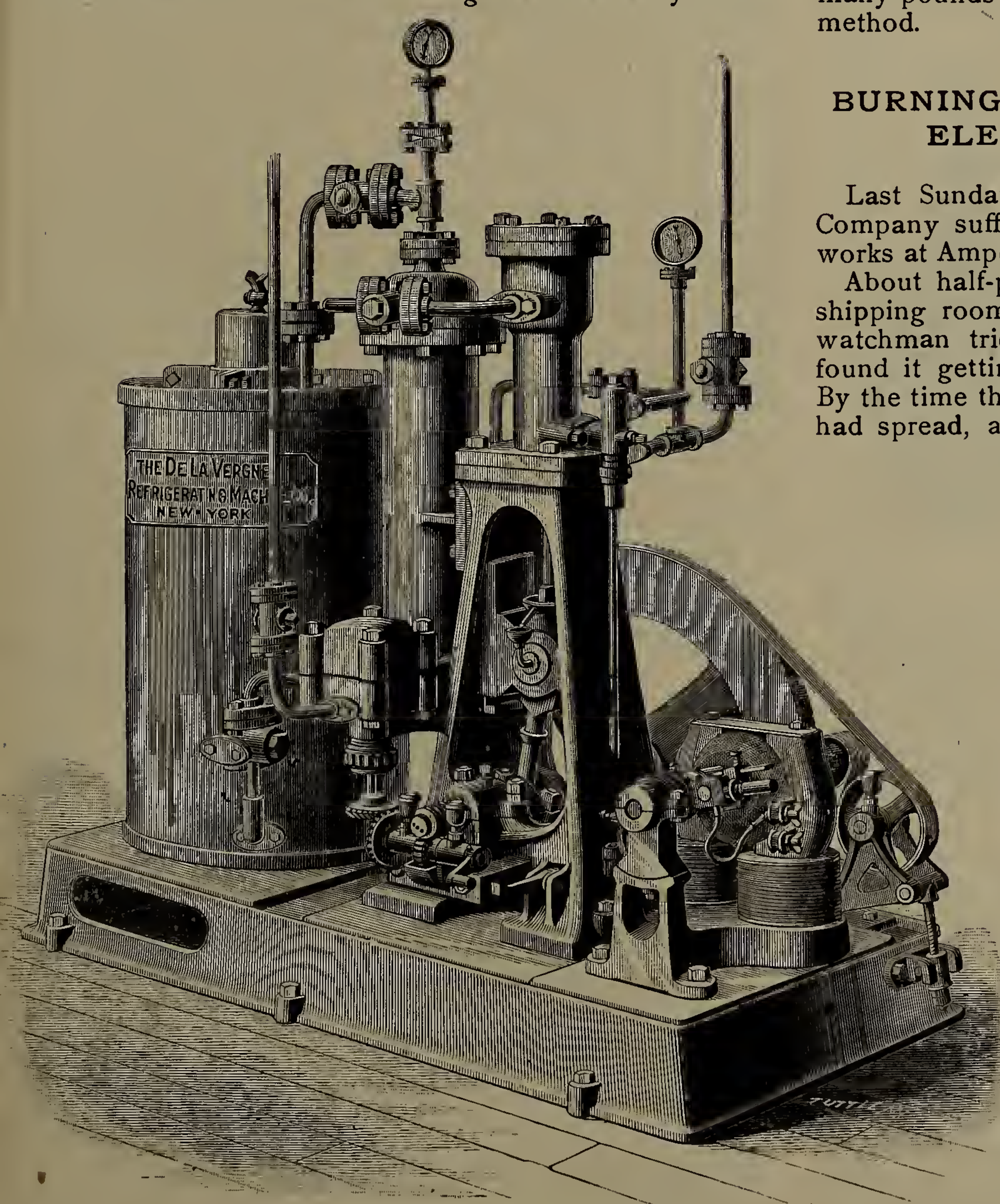
The Safety Insulated Wire and Cable Co., of New York, furnished the flexible Safety cables and wires used in the switchboard and station service of this plant.



C. & C. MOTOR.

Over 3,000 invitations were issued, and the crowd was so great that the exhibit was continued on the night of April 4.

The street front of the building was brilliantly illumi-

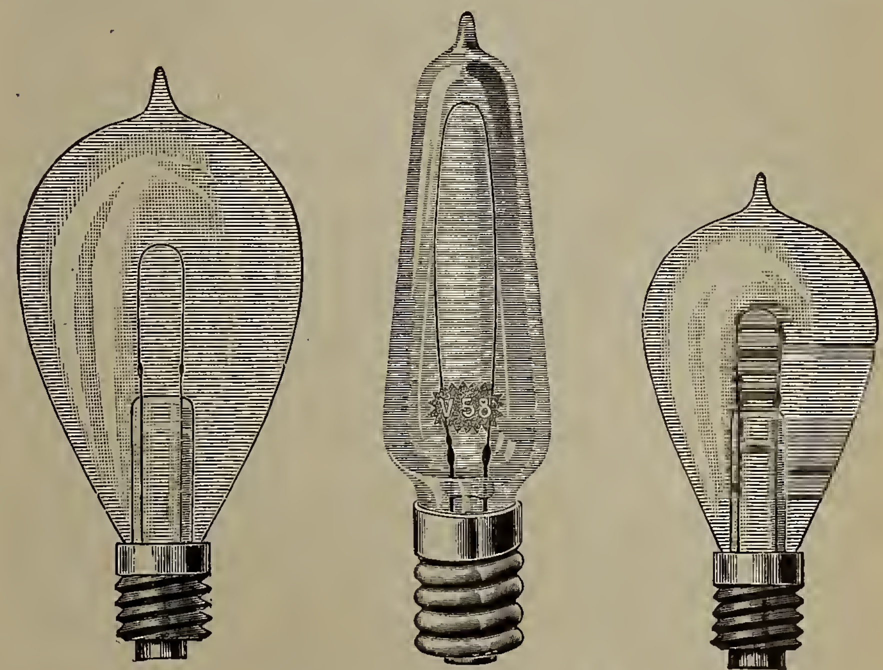


DE LA VERGNE REFRIGERATING MACHINE.

nated by arc and incandescent lamps, and the word "Edison," in blazing letters, aided the visitors in locating the station.

Next door to the station Mr. W. H. Boyes, electrical engineer and contractor, took advantage of the occasion and placed outside an electrically lighted revolving sign showing his name.

The De La Vergne Refrigerating Machine Company, of New York, had one of its refrigerating machines on exhibition. With this system it is possible, by the use of an electric motor, to furnish cooling power sufficient to make



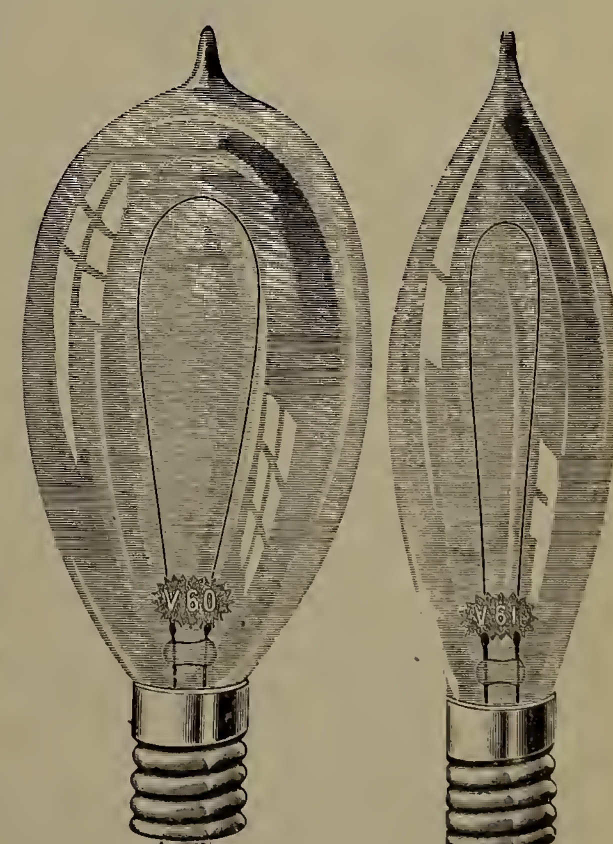
EDISON DECORATIVE LAMPS.

many pounds of ice at a less cost than by the old-fashioned method.

BURNING OF THE CROCKER-WHEELER ELECTRIC COMPANY'S WORKS.

Last Sunday afternoon the Crocker-Wheeler Electric Company suffered serious loss by fire at its extensive works at Ampere, N. J.

About half-past one o'clock fire was discovered in the shipping room, at one end of the main building. The watchman tried to subdue the fire alone, but when he found it getting the upper hand he rung in a fire alarm. By the time the fire department reached the works the fire had spread, and afterwards communicated to the main



EDISON DECORATIVE LAMPS.

portion of the building, where the greater part of the manufacturing is carried on. In spite of the efforts of the firemen the flames were not subdued until the main building had been almost entirely destroyed with its contents.

Over $100,000 worth of motors and dynamos, which were stored in the building, were destroyed, and the

machinery plant, which was also ruined, was valued at $50,000 more. These losses, together with those on the building, etc., will bring the total damage up to $250,000.

The main building was 300 feet long by 40 feet wide, and splendidly lighted by large windows. All the machine tools were operated by individual electric motors, there being no shafting or belting used.

Two hundred employés are thrown out of employment by the fire. The loss is entirely covered by insurance, and it is the company's intention to commence the work of rebuilding at once.

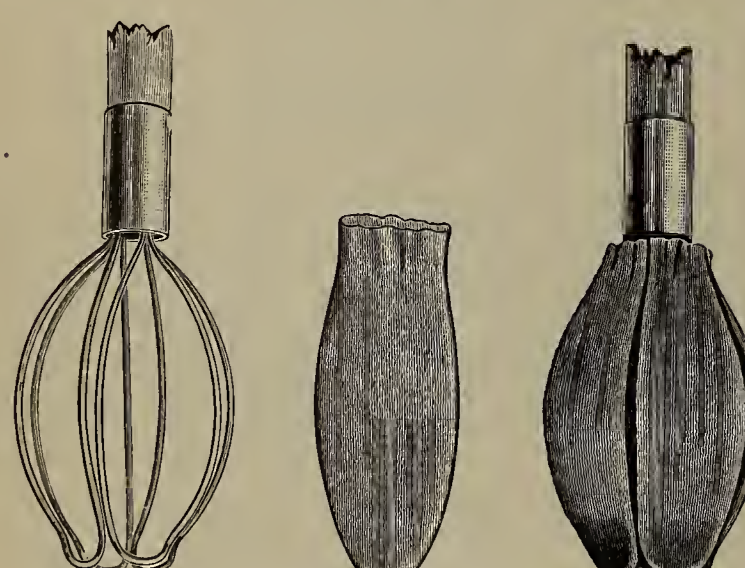
At one time during the fire it was feared that the office building, which stands alone but near to the destroyed building, would also go, but it was finally saved.

Only the brick walls of the main building remain standing, everything else having been destroyed.

INCANDESCENT LAMP CLEANER.

Tests show that one day's accumulation of dust on incandescent bulbs cuts off five per cent. of the light. When, after a liberal supply of dust is allowed to deposit itself on the lamps, the light grows dim, the electrical supply establishment is likely to get a large share of the blame for the poor light.

The cleaning of a lamp seems a simple matter, yet its importance is not fully appreciated. If more attention were given to it, there would be less complaints of poor light.



McCREARY'S LAMP CLEANER.

The accompanying illustration shows a device that is intended to render the cleaning of lamp bulbs an easy matter, with the least expenditure of energy and time. It is one of the specialties for which A. A. McCreary is famous. The three figures show the framework at the end of a three-foot handle, a felt mitten and the frame with the mittens attached. It will be understood from the design of the device that the handle enables the cleaner to reach lamps in otherwise inaccessible positions.

By forcing the frame over each lamp and giving the handle a few turns, the dust on the glass is removed, leaving the glass as clean as when it left the factory. Each cleaner is provided with a set of rubber friction pads that will, when placed over the mittens about half way on the fingers, remove and replace burned out lamps. Extension sticks are also made, each three feet in length, that will, when connected together, reach lamps at any distance.

This incandescent lamp cleaner is so simple and yet so effective that it sells at sight.

Mr. A. A. McCreary, of 136 Liberty street, New York, makes a great variety of incandescent light specialties, many of which have been illustrated and described in the ELECTRICAL AGE in the past.

FRANKLIN ELECTRICAL SOCIETY.—The Franklin Electrical Society will hold its next meeting at 239 East 57th street, New York, on Saturday evening, April 20, at 8 o'clock. E. V. Lallier will deliver a lecture on Arc and Incandescent Lighting, and A. A. Hamerschlag, one on Isolated Plants.

REDUCING THE COST OF ELECTRIC LIGHT.*

BY NELSON W. PERRY.

Could the central station apparatus be kept in operation continuously at its most efficient output, the electric light could be sold to consumers at a considerable discount upon the price of gas, and still net the manufacturer a larger profit than the gas man realizes, and this without any change in apparatus or methods of distribution from those now in vogue.

The gas manufacturer, though he have exactly the same service to meet as the central station manager, is not handicapped by the irregularity of this service, in that he can store up the product which he has to sell, when the product is greater than the demand, and draw upon this store during the hours when the demand exceeds the supply. He need only supply sufficient apparatus to meet the average demand, and this, being kept in continual operation at its most efficient rate, earns to its fullest extent for every hour in the day. The central station manager, on the other hand, has no method of storing up the product which he has to sell. If he employ storage of any kind at any stage of the manufacture, it introduces additional transformations of energy which not only are apt to be expensive in themselves, but also involve necessary losses in final output which must be balanced against any economies which they may present.

It is natural, therefore, that relief should be sought rather in increasing the regularity of the demand than in these methods of storage; but here, too, difficulties present themselves which have not as yet been obviated. In the first place, if a day-load should be acquired it would tend to overlap the maximum lighting load which in winter time comes before six o'clock and on dark days may be an hour or two earlier. The result would be that the double load which at most would last but two hours, and which in the summer time would not exist at all, would have to be provided for by machinery which would be idle the rest of the day. It is clear, therefore, that this change would not better matters much.

What promises to be a better method is one that has been tried on a small scale abroad, but not yet, to any extent, in this country, *viz:* encouraging the use of current during the hours of light-load by reducing the price of service during those hours. The central station manager could well afford to reduce his price to a mere fraction of what he now charges, if by that means he could obtain a steady demand for his product during the 24 hours.

Then there is another method by which relief may be obtained, *viz.*, by finding some by product for the central station man to manufacture during the hours of light-load. I use the term "by-product" advisedly, for it must be something whose manufacture may be stopped the moment the machinery is required for the main business. The manufacture of ice is one such "by-product" that has found some favor among central station men ; but, while this may give employment to boilers and engines during the daytime in summer, the dynamos are lying idle even during the few months when there is a demand for ice, and during the winter months such a plan would afford no relief whatever. It would be far preferable if some electrical product could be found, for this would give employment to all of the machinery at all times of the year when not otherwise required. This, in fact, is the invention which is most required at the present day, and seems more possible of attainment than any other form of relief thus far suggested.

One of the recent products of the electrical furnace that looks promising for this purpose is calcium carbide—a product not new to chemistry, but new to commerce. This substance, which is produced by the fusion of lime and coal-dust in the electric arc, when decomposed by the simple addition of water, gives rise to acetylene gas—one of the most highly luminous gases known, as well as possessing

* From *Engineering Magazine*, April, 1895.

the highest calorific powers of any of the hydro-carbon gases. We, on this side of the Atlantic, have been rather skeptical as to the advisability or practicability of undertaking the manufacture of calcium carbide, but the proposition has been given a standing which at least makes it worthy of consideration by our continental friends, who are about to undertake it. It seems that a company has actually been formed in Germany for this purpose, known as the "Gesellschaft zur Verwerthung von Acetylen-gas." That this is no mere hap-hazard ill-digested concern is evidenced by the fact that the great German electrical concern of Siemens & Halske has taken a substantial interest in the project. Should the undertaking prove a commercial one, it will be of the utmost import to the central station man, and the outcome will be awaited with the greatest interest.

The commercial status of the manufacture remains, however, to be proved. There are two other products, however,—already objects of commercial manufacture—whose status is already determined. One of these is aluminum, and the other carborundum. These articles are already being manufactured on a large scale, and their manufacturers are seeking cheaper power at Niagara to enable them to increase their outputs at lower figures. The questions arise: Would it not pay the central station man to manufacture these products during the hours of light-load, at a figure with which even the cheap water-powers at Niagara could not compete, if by this means he could keep all his apparatus occupied at its best rate throughout the 24 hours, and thereby reduce the cost of his electric light by from 50 to 75 per cent?

CARBIDE OF CALCIUM.

Calcium carbide, which is a product of the electric furnace, has recently come into prominence as a possible rival of the electric light as an illuminant. Its illuminating power is said to be very high, but its profitable production on a commercial scale is a matter yet to be satisfactorily determined.

In view of the attention that has been given this subject of late the following matter, which is taken from an article prepared by Mr. M. P. Wood and published in the *American Gas-Light Journal*, will be of general interest:

From the data furnished by the Electric Gas-Light Company, an electric horse-power of energy in the form of incandescent lights compared with the same amount of energy in the form of calcium carbide gas, will be about as 7 to 11; but these deductions must be received with some caution until a more extended use of the carbide will enable them to be verified.

This difference is not, however, sufficient to enable a steam generated carbide and acetylene light to compete with an electric incandescent light; it would not cover the extra labor and other drawbacks to gaslight.

Although, for the same power expended in light production on the above ratio of 7 to 11, it by no means follows that it would be profitable to manufacture calcium carbide at electric supply stations; the handling of the materials, delivery of the carbide, its package and storage, and delivery in small lots to isolated installatious could never be met by this difference in the power consumed. Other persons' experiences in electrical matters indicate that the difference as above would be nearer 4 to 5, when using incandescent lamps of four watts per candle-power. With lamps working at 3½ volts per candle-power for power, the lights will be equal.

With arc lamps the conditions are completely reversed, for an ordinary arc of 10 amperes at 45 volts, with a globe and a resistance, will furnish one candle light for two volts energy, thus making the light for the same power equal to 80 for the electric arc and 50 for the acetylene light.

Of the heat produced by coal in a boiler furnace driving a steam electric plant, only about five per cent. is recoverable in an electric furnace, hence, the impossibility of economically working electric furnaces by steam power, except when the product, whatever it may be, commands a comparatively high price.

The 180 electric horse-power required to produce a ton of carbide in 12 hours, means 135 units of electrical supply, and the lowest prime cost of such a unit from a central station will be four cents; hence, the power cost per ton of carbide will be $5.40, or nearly ten times the estimate of cost furnished by the Electric Gas-Light Company.

If an adequate supply of water-power can be had at fifty cents per horse-power for 180 horse-power per year, the cost of acetylene gas will be about as its advocates claim for it, *i. e.*, one and a half dollars per 1,000 cubic feet. If the above price will buy 13 units of electricity in the form of incandescent lights, which at four watts per candle-power give 3,250 candle-power, then 1,000 cubic feet of acetylene will give for the same money, 28,000 candle-power for one hour.

As stated by the Electric Gas-Light Company, a ton (2,000 lbs.) of the carbide furnishes the equivalent light units of from 80,000 to 100,000 cubic feet of 22 to 26 candle-power illuminating gas; this duty being that due to a 40 per cent. air and a 60 per cent. gas mixture. The pure acetylene from a short ton of carbide equals 8,000 to 10,000 cubic feet of approximately 240 candle-power gas. These statements of quantity and candle-power are derived wholly from the Electric Gas-Light Company, and have never been verified by any one not ostensibly in their interest, and cannot be until the production of carbide on a commercial basis enables experimenters to determine the qualities of the product unbiased by personal considerations.

Assuming that calcium carbide can be produced and sold at a profit at the price given by the Electric Gas-Light Company, viz., $15 per short ton (which price is problematical), the expense of the acetylene enricher of 200 candle-power will be 21½ cents per 1,000 cubic feet of commercial illuminating gas, and is approximately the same as the cost of the naphtha enricher.

When acetylene is used as an enricher for coal gas, 3 per cent. raises the candle-power from 16 to about 22 candles, and materially whitens the flame. With natural gas, each 1 per cent. of acetylene added as a carbureter increases the candle power from three to four candles, and adds slightly to the heat unit power of the gas about 6 per cent., giving a light of 20 candle-power, and odorizes the gas markedly.

With blue, or water gas, the results of acetylene as an enricher are not so favorable. Experiments have not yet determined the ratio of admixture between the two gases for any given candle-power. Thirty per cent. of acetylene mixed with water gas fails to bring the candle-power up to 20, while the same per cent. of gas naphtha vapor yields a 30-candle gas.

Acetylene diffuses itself thoroughly with coal gas in the holder or with natural gas in the mains, but with water gas it may require some process of fixing not yet determined.

The present stock of carbide is the product from an electric furnace under the control of the Electric Gas-Light Company, and there are no means to verify any statements that may be made by them as to the amount of material used or the product from any given amount of electrical energy.

As stated, two short tons of pulverized coke (of a quality suitable for the manufacture of electric light carbon pencils) is mixed with two and one-half tons of pulverized quick lime—good builders' lime, as free from air slack as possible. This material is put into an open electric furnace, built of ordinary firebricks, the walls being nine or thirteen inches thick, and of any convenient size, say, five feet inside diameter. A cathode connection is made from the iron base plate of the furnace to the dynamo, and the positive pole from the dynamo is connected to the carbon stick (one or more) that enters the open mouth of the furnace, and is made adjustable in any convenient manner. A quantity of the above material is put in the furnace, the current turned on, and, as fusion ensues, the pencil is adjusted to

meet the conditions in the furnace. The product, in the form of the slack-like carbide, is run off in the taphole in the side of the furnace, and the process is continuous so long as material and electrical energy are supplied.

For each charge as above of four and one-half short tons of lime and carbon, two short tons of carbide are produced, requiring an electrical energy of 75 volts and 2,000 amperes—or, approximately 200 horse-power in a 24-hour day; or one horse-power electrical energy produces ten pounds of carbide in a 10-hour day. This amount of product is equivalent to a 44 per cent effect from the lime and carbon used, and it is doubtful if the useful effect can be increased to much over 50 per cent. of the materials charged. The waste in the furnace must necessarily be large, the reactions therein stimulating those of the open hearth, basic steel process, wherein any sulphur that may be in the coke, and any phosphorus that may be in the lime, under the influence of the high heat, will take up their saturated amounts of calcium and be fluxed or vaporized. A further reaction is also shown in the use of the carbide. When exhausted from its gas producing qualities the waste lime, when inclosed in a close vessel for a short time, develops a noticeable odor of ammonia, that may possibly be enough in amount to warrant saving as a fertilizer. Experiments are in order on this point, independent of the Electric Gas-Light Company.

Estimates of the cost of producing carbide presented by the aforesaid company must be received with extreme caution. That any considerable amount of water-power convenient to lines of transportation can be had for $5 rent per horse-power per year is problematical. It will probably average nearer to $10 per year, if not $15.

A modern steam-power electrical plant of, say, 2,000 horse-power, will require about 9½ square feet of floor surface for its development, and will cost, with foundations, about $17 per horse power.

A high speed engine and boiler plant, stack, pumps and all the auxiliaries complete will cost $55 per horse-power.

The electric plant, dynamos, wires, with all instruments and connections ready for work, will cost $40 per horse-power.

Crushers for lime and coke, line shaft, fans, tools, elevators, storerooms for lime and carbide, cooperage, stables, horses and drays, land (five acres), grading, interest and expense account during construction, will require $25,000, or a total capital cost for a 2,000 horse-power steam plant of $250,000.

Upon the basis of 200 horse-power producing two tons of carbide per 24-hour day, the above plant would produce 20 tons of carbide daily.

The cost of operating the above steam plant, using three pounds of coal per horse-power per hour for all purposes (other than for the carbide carbon), at $1 per ton, cartage of ashes, water, labor and all engineering items, salaries, interest, insurance and depreciation upon the building and machinery accounts will be $153 per day for a 310-day year.

The dynamo department, including the depreciation, interest, insurance and a proportional part of all office salaries and expense accounts, will be $61 per day, or a total cost of the power and dynamo departments of $214 per day to produce 20 short tons of carbide, equal to $10.70 per ton, with coal at $1 per ton.

For each dollar added to the price of coal per ton, add $3.60 to the above cost of the carbide.

The pulverized lime at the furnace will cost by the quantity at least 16 cents per bushel of 80 pounds, or $4 per ton of carbide. The pulverized coke for the carbide will cost $2.50 per ton of carbide.

Labor and other items at the furnace, and a proportional part of all office expenses, insurance depreciation, repair of furnace, tools, etc., will be $2 50 per short ton of carbide.

The total cost of the carbide from a steam plant, with coal at $1 per ton, thus equals $19 70 per short ton. The same quantity of carbide from a water-power plant, on the basis of $5 per horse-power per year rent, will cost $16.10 per ton, with an additional charge of about 33 cents per ton for each dollar per year water rent over a five dollar rate.

These are cost prices of the carbide at the manufactory, and do not include any allowance for cooperage and package, royalties, legal expenses, profits to the manufacturing company, etc.

With some contemplated improvements in the electrical service, together with a reduction of the furnace waste and a low rate of wages for all employés, with a location of the works away from all competing employments for labor, it may be possible to produce the carbide for a commercial price of $24 per ton, f. o. b., but this price will only obtain under extremely favorable conditions, and for large quantities, and can in no case afford a base to estimate upon for any change from naphtha to a carbide enricher for a water gas plant. To substitute acetylene enricher for naphtha for the gas used alone in the city of New York would require over 600 tons of carbide daily, to produce which quantity will require over 120,000 horse-power of electrical energy in a 10-hour day.

Domestically, the success of the carbide process for manufacturing gas seems to be well assured at any price for the carbide under $30 per ton. If a ton of the carbide produces the equivalent light units of 100,000 cubic feet of, say, 22 candle-power gas, when mixed with 40 per cent. of air, the cost of the gas will be only 30 cents per 1,000 cubic feet, and the heat unit power will be approximately 900° F. per cubic foot.

The demand for the carbide from isolated plants, hotels, manufactories, country houses, etc., should be almost as unlimited as for coal.

The cost of installation for 30 to 40-light houses already piped for gas will be about $5 per light, when an air mixer and meter is used for a mixed gas. Without the mixer and with the use of pure acetylene the cost will be about $3.50.

Under the average condition of domestic service and attendance it would probably be safer to use the acetylene gas pure or without the air admixture. It would require but a very little disturbance in the working of the mixing meter, or the gas governor attached thereto, to reduce the proportions of 40 per cent. of air and 60 per cent. of gas to that of 20 per cent. or less of air, when an explosive compound would be formed that would be more or less violent, the maximum explosive effect being reached at some point where 10 per cent. of air is mixed with the gas.

The patents that are now in existence that are alleged to cover the manufacture of the calcium carbides are :

1st. No. 486,575, Nov. 22, 1892, to Thos. L. Willson, Leaksville, N. C.

2d. No. 491,394, Feb. 7, 1893, to Thos. L. Willson, Leaksville, N. C.

3d. No. 492,377, Feb. 21, 1893, to Thos. L. Willson, Leaksville, N. C.

IMPROVEMENTS IN STORAGE BATTERIES.*

BY MAURICE BARNETT.

The recent award by the Franklin Institute of Philadelphia to the inventor of the "chloride accumulator" is indicative of the great commercial importance attached to the use of secondary batteries for storage purposes. That the recipient of the medal is a Frenchman is not strange, considering that France is far ahead of the United States in its application of accumulators to the users of central stations for electric lighting and traction work. In Paris alone 21 stations are supplied with these storage cells (containing 760 tons of plates) which run 120,000 lamps. Paris has three lines of cars run by chloride accumulators, while the same system is in use at Cannes, Boulogne, Sur Mér, Nantes, Clichy and other towns. Stimulated by the hope of reward from a new and increasing industry, French genius had been for a long time directed to this branch of electro-economics, with the result that a Frenchman's efforts produced the successful solution of electric storage.

* Abstract from *Engineering and Mining Journal.*

That is why the honor of the award of the Scott medal fell to foreign rather than to domestic genius.

Although electric companies in the United States have been backward in taking advantage of efficient secondary batteries as an adjunct of their generating systems, the recent placing by the Edison Company, of New York, of a large order for accumulators of the French type, is exceedingly suggestive, indicating a tendency to follow the example of foreign companies. The necessity for such accumulators in the central stations of electric lighting companies, for traction work and for large office buildings, is apparent after momentary consideration. In electric lighting stations it is found that during the winter months, for a few hours every night, the generating plant is loaded beyond its capacity, while during the summer months the load is carried easily. It is obvious that a simple generating plant must have a capacity equal to the maximum demand that may be made upon it. Furthermore, the day load at no time of the year is of sufficient importance to justify the expense of running. Inasmuch as day lighting is necessary, electric companies frequently run during that period at a loss to themselves. It is here that the storage battery proves of great commercial value; for with the help of a secondary battery a generating plant does not need to have a capacity sufficient to satisfy the maximum demand, as a much smaller generating plant worked up to its full capacity in connection with a set of accumulators, can store up its surplus output and make a requisition upon it during the hours of the day when the load is in excess of the capacity of the dynamos. Such storage batteries can carry the day load and furnish light on Sundays without the necessity of operating a power plant at those times. Besides the economy in wages and fuel, there is a great opportunity to lower the cost of installing a power and generating plant, as a small generating plant with the aid of secondary batteries can do the work of a large and more costly installation of generators alone. With regard to the lighting of large office buildings it has been the custom either to buy the light from electric lighting companies or to operate a dynamo plant and produce the light in the buildings themselves. Both of these practices involve a rather large tax upon the income of the owners of these office buildings, as, in the first case, the lighting company's charges are frequently excessive, and in the second case, day and night help must be maintained. It is the experience of companies using storage batteries that they can have light every hour of the day, Sundays included, and get along with the help of one engineer. Lastly, the advantages of accumulators to electric railway plants would be obvious if for no other purpose than in saving the engines and dynamos from the great fluctuations of load so noticeable in these plants. In such cases a storage battery soon pays for its installation. If such a system is placed at suitable points along a railway line considerable "feed wire" can be done away with and a more even pressure of current maintained. These auxiliary plants act automatically and require very little attention. Their value is most apparent when it is considered that a break in the supply circuits or a shutting down in the generators does not necessarily involve the stoppage of the cars. Installations of these batteries can be made to carry the whole load late at night and early in the morning, when few cars are running—the income from operating which by generators would not defray expenses. As an instance in which the application of electric accumulators to traction purposes has been crowned with commercial success may be mentioned the two lines of cars running from Paris into the suburb of St. Denis, the combined length of which is 11 miles. The power plant consists of three 150 H. P. boilers, three 150 I. H. P. engines, and a number of dynamos of 250 volts and 300 amperes output each. Each of the cars of the company is furnished with 108 storage cells designed especially for traction purposes, and of a capacity capable of running the car a distance of about 40 miles under the conditions of the severe gradients and curves along these lines. Considering that the gradients are frequently as high as four per cent., that the cars are intended to carry 50 persons, that the weight over all is 28,000 pounds, that 52 batteries of 5,616 cells and 61,776 plates perform an equivalent of 1,550 car-miles daily, and that up to May 1, 1894, one million car-miles had been run since accumulators supplied the motive power—the feasibility of using storage batteries for traction work is very apparent. The success attending the use of these batteries was so great that horse-power was entirely superseded over a year ago, and a new line running from the Saint-Ouen town hall to Neuilly is now being supplied with the same type of accumulator.

Although theoretical and practical considerations affecting electric storage have long held out great promise to the inventor of an accumulator efficient under all the conditions to which it might be exposed, it has only been within a very few years that such a storage cell has been perfected. The cause of this is to be found in the fact that inventors have been led astray for a number of years by erroneous methods; and in trying to make the "pasted" battery meet the demands of modern engineering, have failed most signally. Of late years there has been a tendency to revert to the Planté type of battery, which has been improved by French genius until, in the modernized form of this battery, founded on correct mechanical and scientific principles, we have an accumulator of a very high grade of excellence.

The qualities that a good storage battery must have are:

First. Non-liability to mechanical disintegration after continued use or during rapid charges or heavy discharges.

Second. A large active surface for small weight of elements.

Third. Good contact between the active surface and the inclosing frame.

Fourth. Low internal resistance.

The committee that was appointed to investigate the merits of the "Chloride Electric Storage Battery," or "Chloride Accumulator," handed in its report recently, and recommended the award of the John Scott Premium and Medal to Clement Payen, the inventor. Incidentally, mention was given Mr. Herbert Lloyd, of Philadelphia, for important improvements made in the Payen cell. As this accumulator is considered by the ablest electrical engineers in the country to mark an era in the history of electric storage batteries, a description of its construction will doubtless be of value to any one interested in electrical science.

The method of construction of these cells would seem to make possible of production a secondary battery that would possess the important qualifications, just mentioned, of non-liability to mechanical disintegration after continued use or during heavy discharges, a large active surface for small weight of elements, a good contact between the active material and the inclosing frames, combined with low internal resistance. The active material is obtained, not as in the old way, by cementing lead oxide paste into a frame, but in a manner purely chemical. A mixture of the chlorides of lead and zinc, in certain proportions, is fused and the product cast into pastilles in suitable moulds. When thus cast, the mixed chlorides are of a whitish color, vitreous character and very brittle. The pastilles to be used for negative plates are about $\frac{3}{4}$ in. in cross section and $\frac{5}{16}$ in. thick, and are cast in groups of four which are united by filaments from $\frac{3}{32}$ to $\frac{1}{8}$ in. thick. The "positives" are cast separate—each one having a beveled V-shaped periphery. These pastilles are then placed in a suitable mould, and molten antimonial lead cast around them under high pressure. The feature of casting under pressure is one of the improvements due to Mr. Herbert Lloyd, and has been patented by him. The connecting sheets of the negative groups, the V-shaped bevel of the positives and the casting under pressure combine to make the fixation of the active matter exceedingly good. The frames alternating with zinc plates in metallic contact are then immersed in a bath of dilute zinc chloride. This arrangement acts like a primary battery that has been "dead short-circuited," with the result that the chemical changes which take place effect the removal of the zinc

chloride. There is then left the dense frame of antimonial lead containing, now, pastilles of spongy lead, which are then "formed" in the usual manner.

This lead on examination is found to be crystalized in such a way that the longer axes of the crystals are regularly arranged normal to the surface of the plates. The advantage of this is that between the crystals there are spaces which permit the changes of volume, which occur from the action of the cells, to take place without producing lateral stresses upon the crystals or in any way causing their disintegration. Owing to this circumstance heavy discharges can take place without mechanical violence to the structure. Furthermore, the cohesion of the pastilles of this spongy lead, and consequently of the peroxide of the "formed plates," is very great; for it is well known that "in a crystalline form the molecules of matter are arranged in a different order from what they are in any mechanical mixture. In the mechanical mixture the aggregation of the atoms is strictly fortuitous; that is to say, it is a mere question of chance how they are arranged, and they have no cohesion among themselves beyond that which is given to them by the cementing mixture which holds them together. In the crystaline form, however, all this is changed; the molecules of the body are arranged in perfect symmetrical order, and they are held together by molecular affinities which regulate the order of their distribution and secure the coherence of the mass." In other words the particles of this spongy lead and peroxide are bound together far more strongly than it is possible in "forming" plates by the old method of mechanical mixtures. Beyond this it is obvious that the peculiar structure of this spongy lead admits of a maximum active surface of uniform consistency through the entire plate—save where the antimonial lead frame intervenes. And as the capacity of a cell of given size and weight depends upon the amount of chemically active material, the cell under discussion will require less floor space than other accumulators.

Although the construction just described seems thoroughly effective in preventing the tendency to disintegration, it has nevertheless been considered expedient, as a precautionary method, solely to introduce between the plates a thin sheet of woven asbestos cloth so that any small particles which might be detached could not short-circuit the cell. It is found that this asbestos increases the resistance of the cell to a very small extent—which is compensated for, however, by the fact that the contact in this accumulator is exceptionally good owing to the shape of the chloride pastilles, and to the fact that they were cast in the frame under pressure. The internal resistance is no greater than in other lead cells, being about .002 ohm.

BOSTON'S WIRE DEPARTMENT.

The intent of the act which governs this department, says *Municipality and County*, is to cause the removal from public streets, avenues and highways in the section of Boston bounded southerly by Dover street, westerly by Berkeley street and Charles river, northerly by Charles river and easterly by Boston harbor and Fort Point channel, prior to January 1, 1900, of all wires, cables and conductors, and all poles or structures used for supporting them. This law became operative in June, 1894, when the overhead wires, which were by it ordered removed, measured about 100,000,000 feet. Long distance telephone wires, that is, wires connected with some central office in Boston, and extending at least 25 miles in a direct line from that office, and railway trolley wires, are exempt from the order of removal.

The removal, which means the taking down of "dead" or unused wires, and the placing underground of the remainder is to be spread over 1894, 1895, 1896, 1897, 1898 and 1899, and in each of those calendar years a specified portion of the described territory will be treated, so that not more than one-fourth nor less than one-sixth of the entire district will be undergoing the process of removal in any one year. The work outlined for the year just closed took in the territory (the "South End" district) bounded by the water front and a line following a course along Dover, Tremont, La Grange, Beach, Kingston and Essex streets.

In the 1894 district it was estimated that the order would necessitate the construction of conduits for and the burial of some 10,000,000 feet, or 1,800 miles of wire, but subsequent measurement shows between 6,000,000 and 7,000,000 feet, of which 2,475,000 are "dead." In the entire district there are 100,000,000 feet of high and low tension wires, cables, etc., which must go underground before the year 1900. The amount of work done in 1894 was the placing of ducts underground, which will allow many millions of feet of overhead wires to be done away with. The West End road alone placed underground 186,000 feet of duct; the largest electric light company placed 193,000 feet and other corporations proportionate amounts. The Boston Electric Light Company's stations are some distance from the district treated in 1894, but it desires to place underground the wires which cover the intervening streets at the same time, and for this purpose it has been authorized to issue $360,000 bonds, that being the estimated cost of constructing its underground conduits and placing the wires therein.

The wire department is in charge of a commissioner (John R. Murphy being the present incumbent) who is appointed by the mayor for a term of three years, at an annual salary of $5,000. He has charge of the placing of all overhead wires in the city, the structures on roofs, proper insulation of all wires, the taking down of all "dead" wires, the seeing that all wires are tagged with their owner's name, the inspection of all electric light plants and their installation, the inspection of the interior wiring for electrical purposes of all buildings, the inspection and supervision of all cables and conductors underground all over the city, and the placing underground in the prescribed section of the city, before 1,900, of all wires which are now overhead, except the ones exempted. Whenever attachments, insulation, supports or appliances are unsuitable or unsafe, or the tags or marks (which the law requires shall be affixed at the points of support of all wires) designating the owner or user, are insufficient or illegible, the commissioner must notify the responsible parties. Every wire which has been abandoned, or which goes untagged, must be removed by the commissioner and the cost charged to the owners. It will be seen from this brief enumeration that the commissioner has large powers, and as he is given the authority to petition the supreme court to enforce the provisions of the act he is appointed under, the law is calculated to be and is, very effective.

In January of each year the commissioner must give public notice, by advertising in two daily papers in Boston, twice a week for two consecutive weeks, the fact that during the calendar year the wires within a specified district must be removed or placed under ground, and it is his duty to see that this is done, except in such cases as, to the judgment of the commissioner, it is impracticable as inexpedient to do this. All poles and other supporting structures are included in this order. After a district has been thus put under a removal order no new poles or wires will be allowed therein. After the expiration of that calendar year the commissioner must remove or place under ground any wires that have not been attended to, and the expense of doing this may be collected by the city from the owners or users.

With a view to lessening the amount of tearing up of pavements the law requires that when any paving or repaving is to be done in any part of the whole section (even though it be outside of the district being treated that year) the commissioner must give public notice of this paving, and may order that the wires on the street to be paved shall be placed under ground before the paving is done.

Subject to the regulation and control of the mayor and alderman the commissioner may permit the wires to remain above ground, if in his opinion the public interests do not require them to be placed under ground. Maps and specifications showing the streets required to be used

by corporations desiring to place their wires under ground must be filed with the commissioner and contain full particulars and dimensions regarding the proposed construction.

"CHAPLET FLASH" OF LIGHTNING.

In *Popular Astronomy* for October there is an illustrated description of these flashes of lightning observed by Mr. Stewart, of Colorado, one of which he likens to a string of beads. Such a flash is not entirely new. There was one seen by Gaston Planté, the inventor of the storage battery, about 23 years ago, and he named it the "Chaplet Flash." This is the first on record as far as I know, and I have read pretty widely on that subject; the next was seen by myself just one week after Planté, but I knew nothing of his observation till I read it in the *Telegraphic Review*, London, Eng., several weeks after. Mr. Stewart has witnessed the third, and "Chaplet flash" is a fully descriptive and appropriate title for the phenomena.

The one I saw was during a heavy storm from the southwest and seemed to have ascended from the earth and was drifting with the wind, as I thought, the highest spot of light being decidedly east of the starting-point or lowest flash.

My explanation is (a theory of my own) that electricity being visible or manifested only in connection with solid or ponderable matter, the wave motion of the ether which was started from below or above, as you like, consumed the particles of matter which it met in its passage and thus made the light or lightning. I propounded this theory 20 years ago. It has since come to the front, and is being discussed now by the most eminent authorities, Lord Kelvin, Prof. P. G. Tait, and others.—David Flanery, in *Popular Astronomy*.

Telephone War.—A merry war is now raging between the West Shore Telephone Company and the Hudson River Telephone Company in Kingston, N. Y., and their respective customers are revelling in cheap rates. The former concern, new in the field, offered its service at $30 a year. The older company cogitated awhile, then cut its figure to $25. It is supposed that the new company will make a further reduction, and that all the towns in the Hudson Valley will be drawn into the fight. The customers can stand reduced rates forever.

PORTABLE ELECTRIC LIGHT PLANTS.

The "Greatest Show on Earth" will be exhibited this season by "Buffalo Bill," under the management of Nate Salisbury. Among the features will be two portable electric light plants, made by the Ball Electric Light Company, Twenty-seventh street and Ninth avenue, New York. Each plant is set on a powerful truck built by the Sebastian Wagon Company, of New York. Set below the rear axle of each truck is a burnished sheet steel Clapp & Jones boiler, with copper tube, built under the supervision of Ridsdale & Lewis, New York. Each truck also sustains a 25-h.p. automatic Case engine, connected to a Ball 28 automatic arc light dynamo by means of L. P. D. transmitters. The weight of each wagon complete is five and a quarter tons. The Buffalo Bill people will take these portable plants around the country this season in connection with the show.

Mr. Bailey, of Buffalo Bill's show, has invented a neat and valuable arc lamp globe and reflector combination. Half of the globe is silvered and corrugated on the inside, the other half being plain glass.

NEW ELECTRICAL HEADQUARTERS.

The new Thames building, at the corner of Thames and Greenwich streets, New York, is becoming an electrical centre. It is a substantial building, and is fitted throughout with all the modern conveniences. It is opposite the building of the Western Electric Company, which is on the south side of Thames street, the Thames building being on the north side of the street.

The second floor of the building is occupied by the Public Telephone Company in the manufacture of the latest Shaver patented telephones of all styles and for all purposes. The company is installing a 5-h. p. electric motor to run the machinery in its factory. The Prentiss Tool and Supply Company, 114 Liberty street, will fit the factory out with the necessary machinery.

C. J. Southard, the electrical engineer and contractor, will occupy offices on the floor over the Thames street entrance.

Doubleday, Mitchell & Co., will, on May 1, take possession of a fine suite of offices. They invite their friends to call and see them at their new quarters on that date.

The Elson-Brewster Company, the electrical engineers and contractors, will have offices and salesrooms in the new building. This company represents the Belknap Motor Company, of Portland, Me.

The Nassau Electrical Company has taken offices in the Thames building, and after May 1 will receive orders in the new quarters for the well-known "Capo-Farad" batteries. A cell of this battery can be carried in the vest pocket. It is a little giant, and it would not be safe to carry it in the same pocket with a load of dynamite.

G. W. Blanchard, electrical engineer and contractor, will locate in the new building on May 1, when he will be ready to receive orders for light and power plants.

McLeod, Ward & Co. will occupy fine offices and larger quarters than the present. They will have a fine display of ceiling and ventilating fans, electric power blowers, exhaust fans, dynamos and motors, all in operation.

The R. Kirtin Company construction business, will occupy quarters on May 1.

A Van Vechten & Co. will have a full line of wood pulleys and other power supplies.

C. H. Tucker, Jr., agent, will have a good line of machinery.

The Manhattan Specialty Company will open on May 1 with a fine line of goods.

The Higley sawing and drilling machine is being shown in this building to great advantage.

Mr. F. W. Sharp is the agent for the Thames building, and has been successful in finding desirable tenants.

THE SAFETY INSULATED WIRE AND CABLE CO.

The Safety Insulated Wire and Cable Company is now settled in its new offices and salesrooms on 28th street, New York, where it has better and larger facilities for the transaction of its rapidly expanding business. This company occupies a position in the foremost ranks of wire manufacturers, and has acquired a reputation for excellence of products that is unexcelled. The success and standing of the company are largely due to the efforts of Mr. Leonard F. Requa, the electrician and general manager. Mr. Requa is a chemist and electrical engineer of note, and has been associated with the business of manufacturing insulated wires and cables for the past 15 years. He is the inventor and patentee of the method of covering cables with seamless lead, which is now so extensively used. Through Mr. Requa's enterprise the Safety company's cables for light, power, telegraph and telephone service are extensively used in the principal cities throughout the country, and are giving the best of satisfaction.

CHEAP BOOKS.

The Voltaic Cell, by Park Benjamin, has been reduced in price from $5 to $3.

P. F. Mottelay's Translation of Gilbert's De Magnete has been reduced from $4.00 to $2.50.

Both of these works are rich and invaluable in every complete library.

They can be had by addressing the Electrical Age Publishing Company, World Building, New York.

TELEGRAPHERS OF TODAY.

Mr. J. B. Taltavall, proprietor of the *Telegraph Age*, New York, has gotten out a book entitled "Telegraphers of To-Day." It contains half-tone illustrations of the features and biographical sketches of nearly a thousand prominent telegraphers, including the presidents and other officials of telegraph companies, cable companies, etc. The work is an elegant one in every respect. Many persons prominent in the electrical field, outside of the telegraph, are represented. As many of those at present engaged in the electrical industries were formerly connected with the telegraph service in one capacity or another, it will be a pleasure to them to have a picture and personal reference of their former friends and associates.

Telephone Notes.

A telephone line is to be established between Nassau and Albany, N. Y.

New Telephone Companies.

The Middleburg and Oak Hill Telephone Company, Middleburg, N. Y.

The Winnsboro and Ridgeway Telephone Company, Winnsboro, S. C.

Telephone Patents Issued April 2, 1895.

Telephoning Apparatus. William B. Robeson, Philadelphia, Pa (No. 536,705.)

Telephone.—John Serdink. San Antonio, Texas. (No. 536,763.)

Telephone Exchange System And Apparatus Hammond V. Hayes and Theodore Spencer, Cambridge, Mass. (No. 536,787.)

Telephone. Fred. H. Brown, Chicago (No. 536,914.)

New Corporations.

The Coney Island and Brooklyn Railroad Co , Brooklyn, N. Y. Capital stock, $100,000.

A company is about to be organized in Spencer, Mass., to establish an electric railroad from Spencer to West Warren, by I. L Currier, of Worcester, president; John Mulcahy, Hiram Gerald, Abin Hyde, and others. Capital stock to be $200,000.

The Interstate Telephone & Telegraph Co., Durham N. C., by L. A. Carr, president; Dr. Fahrney, of Frederick, Md., vice-president, J S. Carr, secretary and treasurer and Edgar L. Miller, of Frederick, Md., general manager. Capital stock, $100,000.

The Winnsboro and Ridgeway Telephone Co., Winnsboro, S. C., by W. D. Douglas, Jas. Q. Davis, E C. Heins and M. W. Doty.

The Middleburg and Oak Hill Telephone Company, Middleburg, N. Y., by Elias W. Dutton, Azano B Brayman, W. J. Chase, William Earle and others. Capital stock, $50,000.

The Hoosic Electric Power Company, Reedsboro, Vt., by W. S. Kelly, of Boston, and others. Capital stock, $100,000.

The Winnsboro and Ridgeway Telephone Company, Winnsboro, S. C., by W. D. Douglas, James Q. Davis, E. C. Heins and M. W. Doty.

Rawson Light and Power Company, Leicester, Mass., incorporated with E. L. Watson, president; W. C. Watson, treasurer, and W. F. Whittemore. Capital stock, $25,000.

The Austin Electrical Co., Austin, Texas, by E. B. Fisher, Q. C. Horton, and J. C. McGillevary. Capital stock, $5,000.

Possible Contracts.

It is expected that construction work on the electric railway in Brattleboro, Vt., will soon begin.

An electric power-house is to be constructed across Miller's river, Miller's Falls, Mass. Two water-wheels will furnish power to operate the electric system.

A company is being organized in Bainbridge, N. Y., to establish an electric light plant in that place. The town clerk can give further information.

The remodeled opera house in Lock Haven, Pa., is to be lighted by electricity. T. Smith, Johnstown, Pa., is the architect.

John T. Williams, 50 Franklin street, New York City, will build a fifteen-story building, to cost $600,000, on Nassau street. The building will be equipped with every electrical improvement.

Architect R. Naynicke, 111 Fifth avenue, New York City, has prepared plans for a large office building for the J. C. Ayer estate.

The Nanticoke Street Railway, Wilkesbarre, Pa., is to be extended.

An electric railway from Penn Yan, N. Y., to Dundee, N. Y., is projected. The town clerk, Penn Yan, N. Y., can give further particulars.

Contracts for the construction of the Gloucester, Beverly and Essex Street Railway, Gloucester, Mass., will soon be given out. Address President Ferguson for further particulars.

The Clyde Electric Light Company has applied for a franchise in Clyde, N. Y., to build an electric light plant. Address the secretary of the company for further particulars.

The Detroit Street Railway Company, Detroit, Mich., will erect a new power-house.

The Hartford Life Annuity and Insurance Company, Hartford, Conn., will erect a large office building after the plans of Architect F. R. Comstock, 302 Asylum street. The structure is to cost $125,000.

The Dexter and Brownsville Street Railroad Co., Dexter, N. Y., has applied for permission to construct, maintain and operate an electric street railway between the points named. Wm. H. Winn, village clerk, can be addressed.

The trolley line is to be built from Doylestown, Pa., to Philadelphia, as soon as possible. The secretary of the Bucks Town Street Railway Co. can be addressed.

We are informed that the Paterson Electric Railway Co., Paterson, N. J., has decided to double track its line from this city to Passaic. The secretary of the company can be addressed for details.

It is reported that the Montclair Town Council, Montclair, N. J., will grant the franchise which was applied for by the North Jersey Traction Co. The secretary can be addressed for detailed information.

Sealed proposals are to be advertised for by the village trustees, Chatham, N. Y., for lighting the streets with electricity for a term of five years. Address the village clerk.

The Anthony Electric Co., Newport, Ky., proposes to establish a telephone exchange.

The Wicomico Telephone Co., Salisbury, Md., has been granted a charter to extend its lines to several localities in that vicinity.

The St. Elmo & Lookout Mountain Railway Co., Chat-

tanooga, Tenn., proposes to build a power plant on Lookout Mountain. Further particulars can be had of Thos. E. Brown, Jr., engineer, Chattanooga, Tenn.

W. A. Jetter, Brunswick, Ga., has applied for a franchise to build an electric railway in that place.

S. J Martenet, Baltimore, Md., has secured a franchise to build an elec'ric railroad in the Nothern part of that city.

The Monroe Athletic Club, Monroe, La., is in the market for an electric light outfit. Chas. G. Madison, Monroe, La., may be addressed.

Chas. W. Sprinkle, Pennsboro, W. Va., wants prices on an electric light plant of 500 or 600 incandescent and 25 arc lights, for a town of about 1,200 inhabitants.

It is reported that the plant of the Saratoga Gas and Electric Co. is to be sold on May 28, next.

The Tiffin (Ohio) Edison Electric and Illuminating Co. has increased its capital stock from $28,000 to $50,000.

The Scottsdale Pipe Works. Scottsdale, Pa., are in the market for electric cranes for their new foundry.

The Canandaigua Electric Light Co., Canandaigua, N. Y., has secured the right to operate in Wayne and Ontario Counties.

O. Arnold, Bardstown, Ky., will, on May 1, let the contract for an electric light plant for that place.

George E. Heriman, Flushing, N. Y., can give information concerning the erection of an electric light plant in that place.

Financial.

The Edison Electric Company, of New York, it is reported, will issue $15,000,000 in 5 per cent. bonds. Four million, three hundred and twelve thousand dollars of this will be held to retire the present first mortgage fives.

New York Notes.

Office of the Electrical Age,
World Building, New York,
April 8, 1895.

Mr. J. F. Macartney, electrical engineer of the Fiberite Company, Mechanicsville, N. Y., is in town.

Noll & Sibley, Postal Building, have been appointed selling agents for New York and vicinity for incandescent supplies made by the General Electric Co.

Mr. Chas. A Bramhall has just opened a New York agency for the Standard Thermostat Co., Peabody, Mass. Mr. Bramhall's office is at Room 98. No. 39 Cortlandt street, where he will carry samples of the arc lamps for direct circuits made by his company.

Doubleday, Mitchell & Co., will, on May 1, move into larger quarters in the Thames Building, cor. Thames and Greenwich streets. They will occupy rooms 101, 102 and 103, and will carry a largely increased stock of American Circular Loom Flexible Tubing and other electrical specialties.

Belden & Seely, 121 Liberty street, New York, have the contract to extend the Lockhaven Electric Railway, Lockhaven, Pa., to Jersey Shore and Salina, Pa., a distance of 15 miles. This railway has been leased by the Lockhaven Traction Co. Belden & Seely are completing their electric railway plant in Syracuse. The road is being extended 15 miles, which will make the total length 21 miles.

W. T. H.

Trade Notes.

F. R. Chinnock, Havemeyer building, has just closed a contract for a complete electric light plant for the yacht Wildwave, which has just been purchased by General Charles C. Dodge, vice-president of the Long Beach Association. Mr. Chinnock will also furnish the engine to run the electric plant. It will be one of the finest yacht equipments hereabouts.

Mr. F. H. Larkin, manager of the Eastern office of the Reynolds-Corliss engine, manufactured by the E. P. Allis Company, Milwaukee, Wis., reports that his company last year shipped on the average each day engines of 475 h. p. This year the figures have gone up to 500 h. p. every twenty-four hours.

The Public Telephone Company have moved into fine quarters in the Thames building, Thames and Greenwich streets. They occupy the floor over the entrance, and will manufacture on a large scale the Shaver long distance telephone, invented and patented by George F. Shaver. Mr. Shaver is one of the earliest telephone inventors. His new long-distance telephone is designed on entirely new principles. The transmitter is one of the most sensitive made, and the receiver is loud talking, and can be heard distinctly some distance away. In the construction of his transmitter Mr. Shaver employs pulverized carbon between two carbon electrodes of peculiar construction. Patents are pending on this construction. The Public Company makes all styles of phones—portables for desk use and the stationary wall instruments. They also make a complete office set, with an automatic call system.

WOVEN WIRE BRUSHES.

The Belknap Motor Co., of Portland, Maine, are the patentees and manufacturers of the best woven wire commutator brush on the market.

Electrical and Street Railway Patents.

Issued April 2, 1895.

536,608. Electrical Transformer. Malcolm Dickerson, Fort Wayne, Ind., assignor of one-half to John F. Curtice, same place. Filed Nov. 26, 1894.

536 611. Cable Railway. Charles I. Earll, New York, N. Y. Filed June 18, 1894.

536,655. Terminal Attachment for Flexible Conductors. Wilton L Richards, Malden, assignor to the American Bell Telephone Company, Boston, Mass. Filed Sept. 10, 1894.

536,664. Car-Fender. Charles B. Stuart, Boston, Mass. Filed Nov. 17, 1894.

536,665. Car-Fender. Worthington B. Thomas, Philadelphia, Pa. Filed Nov. 19, 1894.

536,684. Self-Locking Cleat for Electric Wiring. Frank O. Creager, Marseilles, Ill. Filed Jan. 14, 1895.

536,689. Electric Battery. Hosea W. Libbey, Boston, Mass. Filed Feb. 23, 1894.

536,704. Safeguard for Cable or Electric Cars. George Rischmuller, San Francisco, Cal. Filed Feb. 24, 1894.

536,705. Telephoning Apparatus. William B. Robeson, Philadelphia, Pa. Filed Sept. 7, 1894.

536,708. Car-Fender. Charles P. Stimpson, Troy, assignor of one-half to Phebe R. Gunnison, Lansingburg, N. Y. Filed Nov. 7, 1894.

536,730. Electrical Controlling System for Elevators. Cyprien O. Mailloux, New York, N. Y. Filed Dec. 20, 1894.

536,748 Dynamo Driven from Axles of Railway-Cars. William Biddle, Brooklyn, N. Y. Filed May 31, 1894.

536,763. Telephone. John Serdinko, San Antonio, Tex., assignor to the National Union Telephone Company, same place. Filed Dec. 4, 1894.

536,764. Electric Block-Signal. Fred. P. Snow, Lynn, Mass. Filed Apr. 27, 1894.

536,787. Telephone-Exchange System and Apparatus. Hammond V. Hayes, and Theodore Spencer, Cambridge, assignors to the American Bell Telephone Company, Boston, Mass. Filed Sept. 10, 1894.

536,794. Electric Controller. Gustaf Valley, Cleveland, Ohio, assignor to The Steel Motor Company, same place. Filed Dec. 3, 1894.

536,795. Switch for Street-Car Controllers. Gustaf Valley, Cleveland, Ohio, assignor to The Steel Motor Company, same place. Filed Dec. 8, 1894.

536,803. Contact-Finger for Electric Controllers. Samuel Harris, Cleveland, Ohio, assignor to The Steel Motor Company, same place. Filed Dec. 5, 1894.

536,806. Fender or Life-Guard. Henry Henthorne, Newark, Ohio. Filed June 25, 1894.

536,811. Electric Mercurial Switch or Contact-Maker. Hermann Lemp, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed July 26, 1888.

536,816. Combined Dynamo-Electric Generator and Current-Director. James F. McElroy, Albany, N. Y., assignor to the Consolidated Car-Heating Company, Wheeling, W. Va. Filed Jan. 2, 1892.

536,828. Supply System for Electric Railways. Albert C. Crehore, Ithaca, N. Y. Filed July 22, 1893.

536,852. Car-Fender. Obe. Cullison, York, Pa. Filed Oct. 19, 1894.

536,855. System of Electrical Propulsion for Railway-Cars. Leon Dion, Natick, Mass. Filed June 14, 1894.

536,856. Shade for Incandescent Lamp Globes Leon Dion, Natick, Mass. Filed June 14, 1894.

536,857. Means for the Insulation of Conductors of Electricity. Leon Dion, Natick, Mass. Filed Dec. 6, 1894.

536,871. Electric Double-Semaphore Block-Signal. Nathaniel O. Goldsmith, Cincinnati, Ohio. Filed March 24, 1894.

536,872. Electric Block-Signal. Nathaniel O. Goldsmith, Cincinnati, Ohio. Filed March 24, 1894.

536,873. Anti-Friction Truck for Cars, Etc. Jas. P. Harper, Westport, Mo. Filed October 26, 1894.

536,914. Telephone. Fred. H. Brown, Chicago, Ill., assignor, by mesne assignments, to the Economy Transmission Company, same place. Filed Oct. 17, 1894.

536,915. Supply System for Electric Railways. John M. Byron, New York, N. Y. Filed June 16, 1894.

536,923. Safety Device for Electric Railways Having Sectional Conductors. Leon Dion, Natick, Mass. Filed June 14, 1894.

536,926. Electric Clock-Winding Mechanism. Martin V. B. Ethridge, Everett, and Joseph H. Eastman, Boston, Mass., assignors to the Century Clock Company, North Berwick, Me. Filed April 28, 1894.

536,952. Conduit Electric Railway. Tyre C. Hughes and Arthur W. Adams, St. Louis, Mo., assignors of one-half to Ewing Hill and E. C. Smith, same place. Filed Feb. 12, 1894.

536,963. Dynamo-Electric Machine. James F. McElroy, Albany, N. Y. Filed July 24, 1894.

536,967. Trolley Support for Electric Railway Cars. Emil B. W. Reichel, Charlottenburg, assignor to Siemens & Halske, Berlin, Germany. Filed Oct. 25, 1894.

536,973. Brush Holder for Dynamo-Electric Machines and Motors. Gustaf Valley, Cleveland, Ohio, assignor to the Steel Motor Company. Filed Dec. 15, 1894.

536,974. Electric Organ Coupling Mechanism. Edwin S. Votey, Detroit, Mich. Filed April 7, 1894.

536,975. Electrically Controlled Magnet and Valve for Pipe Organs. Edwin S. Votey and William D. Wood, Detroit, Mich. Filed April 7, 1894.

536,977. Electromagnet for Pipe Organs. Edwin S. Votey, William B. Fleming and William D. Wood, Detroit, Mich. Filed April 7, 1894.

ELECTRICAL AGE

VOL. XV., No. 16. NEW YORK, APRIL 20, 1895. WHOLE No. 414

ESTABLISHED 1883.

Entered at New York P. O. as second-class matter, January 18, 1891.

THE ELECTRICAL AGE PUBLISHING CO., PUBLISHER

TERMS OF SUBSCRIPTION:

One Copy, one year,	$3.00
One Copy, six months,	1.50
Great Britain and other Countries,	4.00

Cable Address (all Cables,) "Electage," New York.

W. T. HUNT, President. F. N. BASSETT, Vice-President.

T. R. TALTAVALL, Secretary and Editor.

NEWTON HARRISON, E. E., Scientific Editor.

Canadian Representative, E. W. SAYER, Montreal, Que.

ADDRESS ALL COMMUNICATIONS TO

THE ELECTRICAL AGE PUBLISHING COMPANY,

FIRST FLOOR, WORLD BUILDING.

NEW YORK.

NEW YORK, APRIL 20, 1895.

CONTENTS.

ELECTRICITY AT THE ATLANTA EXPOSITION.

Mr. Luther Stieringer, who was consulting electrical engineer at the World's Fair, has been in Atlanta, Ga., in connection with the scheme to illuminate the exposition grounds by electricity. Mr. Stieringer has a new and original plan for producing electrical effects on the lake at the Atlanta Exposition, which he thinks will excel anything of the kind ever before projected.

THE DEATH OF MR. PHELPS.

We extend to the relatives and immediate business associates of the late George M. Phelps our heartfelt sympathy in their bereavement and loss of so true and tried a friend as was the deceased. In consequence of Mr. Phelps' death, Mr. T. C. Martin has been elected president, Mr. Joseph Wetzler, vice-president and treasurer, and Mr. A. C. Shaw, secretary and business manager of *The Electrical Engineer*.

TOO MUCH RESISTANCE.

There is considerable complaint among the merchants of London and Paris over the inadequate facilities furished between the two cities by the telegraph and telephone. During the daytime it takes from one to three hours for a telegram to go from one city to the other, and on the telephone lines things are as bad. Those desiring to use the telephone are compelled, in some cases, to wait two or three hours before their turn as the "next gent" comes. This condition of things reminds us of the story to the effect that it once took two hours to transmit a telegram from the headquarters of one of the telegraph companies in this city to the Astor House, a few blocks distant.

EARLY TELEPHONES.

An interesting bit of history comes to us by way of London regarding the telephone. Prof. Hughes, the inventor of the Hughes microphone, at a recent banquet of telephone people in London, referred to the earliest known record of a theoretical electric telephone. In 1854, Du Moncel recorded in his "Exposée des Applications" a method of transmitting sounds and speech by electricity, conceived by a French telegrapher, named Charles Bourseul. The idea there outlined describes the practical telephone of today with surprising accuracy. Unfortunately for Mr. Bourseul, but fortunately for Alexander Graham Bell and others, however, the idea was not at the time carried out in a practical way. In 1865 Prof. Hughes exhibited before the Russian Emperor the telephone which Philipp Reis had just brought out. With it he transmitted and received musical sounds without difficulty, also a few spoken words, but the reproduction of the latter for some unexplained reason were uncertain. For a few moments words were clearly rendered, then without any apparent reason none could be heard. On this latter fact hinges the question as to whether Reis' telephone was or was not a "speaking" telephone. It was contended during the Drawbaugh telephone suit a few years ago that it was not a speaking telephone; that it had never reproduced spoken words, etc., etc., while on the other side the contrary was argued. It can now be accepted as a fact, however, that the Reis telephone was a talking instrument, although imperfect and unreliable. This proof, coming from no less a person than Prof. Hughes, who was one of the earliest telephone workers and who was familiar with all the early facts as they occurred, settles conclusively the point on which there was so long an honest difference of opinion among the later workers in the telephone field. We reproduce on another page these interesting remarks of Prof. Hughes. They throw a good deal of light upon the subject of the early beginnings of the telephone.

THE IMPROVED BALL SYSTEM OF ELECTRIC ARC LIGHTING.

BY F. B. WIDMAYER.

The Ball Electric Light Company, of No. 404 W. 27th street, New York City, has, during the past year, made great improvements in its well-known arc system, both in the mechanical and electrical details.

The efficiency of the Ball system of arc lighting has been proved by the test of time, and a description of the same, as improved, will be of interest to our readers.

The most important part of an electric light system, of course, is the dynamo. The Ball dynamo, or generator (fig. 1), has been in extensive use for the past ten years, and its unique design and the great advantage it possesses are so well known that it is hardly necessary to give a detailed description of the machine at this time. It has shown itself to be most efficient, and the convenience with which it can be handled alone, or coupled up with dynamos of different makes, has gained for it considerable praise from those who have used it for lighting purposes.

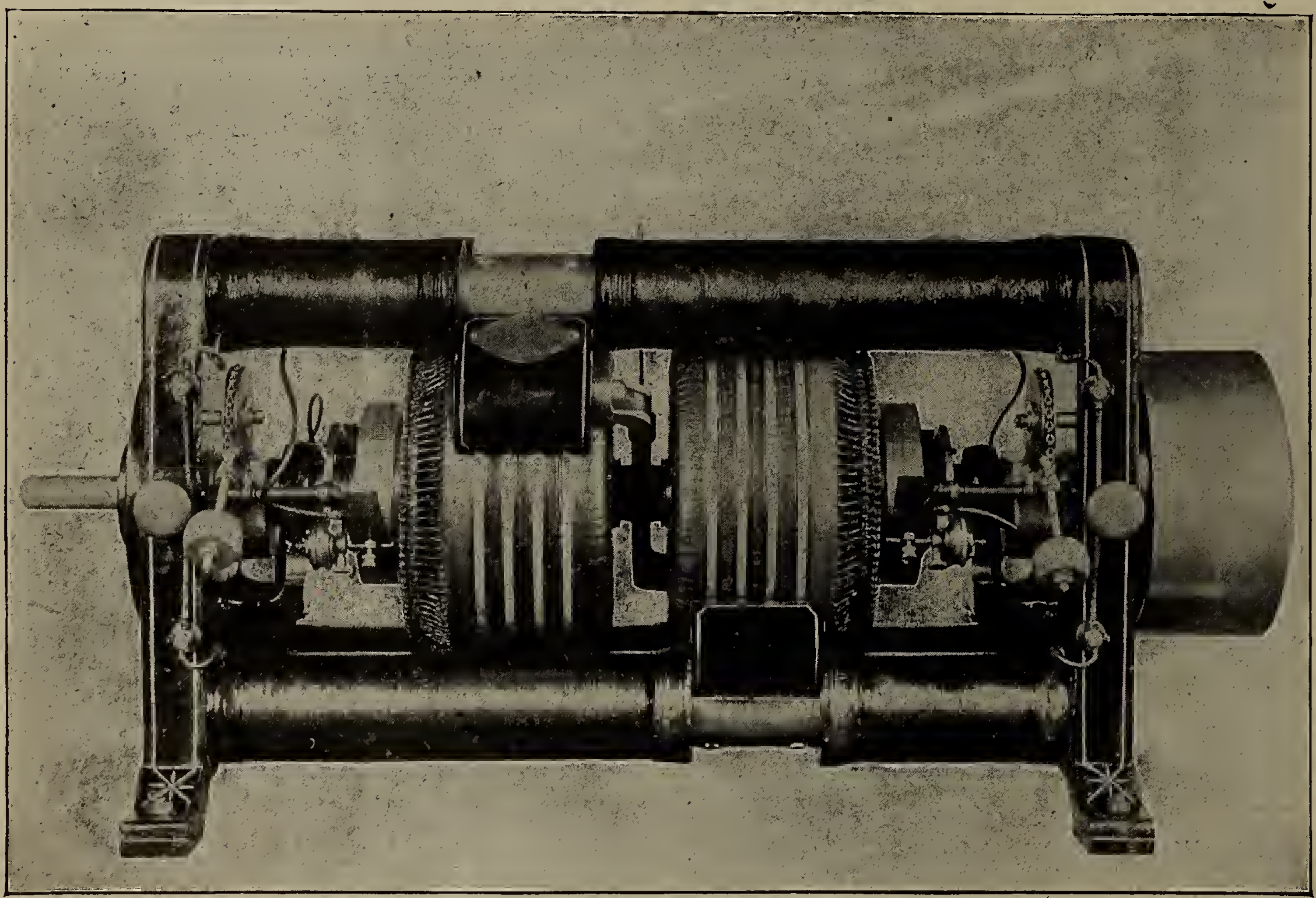


FIG. 1—BALL IMPROVED 100-LIGHT DYNAMO.

The Ball dynamo, as previously constructed, although not automatic in its action, could be perfectly regulated by the movement of the brushes over the commutators. Even without a regulator, the Ball dynamo has been considered far superior to machines of other makes with so-called regulators, regulating coils, etc. Users of hundreds of Ball machines in the United States, Canada, Central and South America, and other countries, all speak highly of the ease with which these dynamos can be regulated. Many of the machines of other makes require the same amount of power to drive them with only one light on as it does when fully loaded, but the new Ball automatic dynamo is a self-regulator, taking care of itself, provided there is power to drive it, and it does not require the constant presence of a dynamo tender to alter or change its brushes, or to cut in and out resistance as the load was increased or decreased, as other dynamos do.

The improved Ball dynamo is automatic in itself, and regulates from one light to full load; requiring power only in proportion to its load. When lights are switched in or out of circuit, there is a corresponding increase or decrease in the power necessary to drive the dynamo. This point should not be overlooked, as it directly affects the coal pile—and a dollar saved in coal and labor in lighting plants is a dollar earned in dividends.

The new Ball automatic dynamo was designed and patented by the company's electrician, Mr. R. E. Ball. Its regulator differs from all other regulators in use, in principle, construction, and operation. It is entirely self-contained, and is a part of the machine itself. The automatic dynamo depends for its action on the following well-known principle: "If a movable magnetic body be included within a magnetic circuit it will tend to place itself so that its axis of least magnetic resistance will be parallel to the lines of magnetic force traversing that magnetic circuit, and tend to take this position with a force depending upon the magnetic flow through it." In carrying this principle into effect the brush-holder, or yoke, becomes the movable magnetic body. It is mounted on non-magnetic ball bearings, and is changed in construction and shape so as to fit into a recess in the end frame, thereby receiving the direct magnetic circuit of the dynamo. It will be seen that the impulse to regulate or govern is direct, and acts positively on the part that must be moved. There is no intervening mechanism, no coils of wire, no wall controllers, and no wire resistance to be actuated. The dynamo itself is changed in parts only so that one may act directly upon another, making the machine self-governing.

Fig. 1 shows this new type of automatic dynamo complete, with its two automatic end frames, self-oiling bearings, etc. Figs. 2 and 3 show the details of the movable magnetic body or regulator, fig. 2 giving a front view, with the brass front plate removed to show the interior construction, while fig. 3 shows a cross-sectional view taken through the end frame and regulator as indicated by the dotted lines KK.

HH is the cast-iron end frame, which is hollowed out, leaving a cavity, as shown. In this cavity is placed the movable magnetic body, AA. KK, K'K', represent the latter in the direction of magnetic axis of the least resistance, while CC is the axis of greatest resistance of the magnetic body, AA.

This movable magnetic body, AA, is properly supported on a non-magnetic plate or hub, BB, which in turn is supported in the rigid bearing, LL, by means of two rows of non-magnetic balls, EE, thus forming an almost frictionless bearing, and insuring the utmost freedom and ease of movement to the movable magnetic body, AA. The magnetic stress actuating AA in the direction indicated by the arrows is counterbalanced by gravity by means of the disk or cam, N, and the adjustable weight, N′, as shown.

The other end of AA is fitted with a stop and dash-pot, represented at P. Extension arms, i i, carry the holders for the brushes on the commutator.

When the magnetic plate or disk is in the position shown in fig. 2 the brushes are on the points of the commutator represented by the line M, and at position of full load, or place of greatest potential—when the machine is generating its normal current and operating its full capacity.

When lamps are cut out the excess of current is thrown back on the field coils, thereby increasing the magnetism and lines of force flowing through end frame, H, and disk AA. The magnetic stress now being stronger than the counter pull of the weighted arm, N′, acting upon the magnetic disk or body, AA, tends to move it in the direction indicated by the arrows, and with it the brushes on the arms, i i, toward the neutral point or point of lowest potential on the commutator. The weakening of the strength of the current in the field necessarily diminishes the number of lines of force in the end frame, etc., until equilibrium is established, or, in other words, until the normal magnetic force, acting upon the movable magnetic body, AA, is again balanced by the force of gravitation acting upon it by the lever and weight N and N′.

On the other hand, when lights are added the current falls, so weakening the magnetic force traversing the end frame and magnetic body or disk, AA, that the force of gravitation becomes stronger, thrusting upwards the plate, A, and brushes to the point on the commutator of highest potential, thereby increasing the current in the fields and external circuit to its normal flow; consequently the magnetism of the end frame and disk, A, is restored to its normal state and a balance is again established.

This regulation is absolutely automatic from one light to full load, and almost instantaneous in its action. A 65-light automatic dynamo equipped with these regulators has been frequently short-circuited on full load, but the regulators have always performed their function instantaneously. A 100-light dynamo equipped with these regulators can be short-circuited and run for days without any ill effects upon the dynamo, regulator or armature. So speedy and so sensitive is the action of this regulator that it is necessary to provide an adjustable dash-pot, P, to arrest

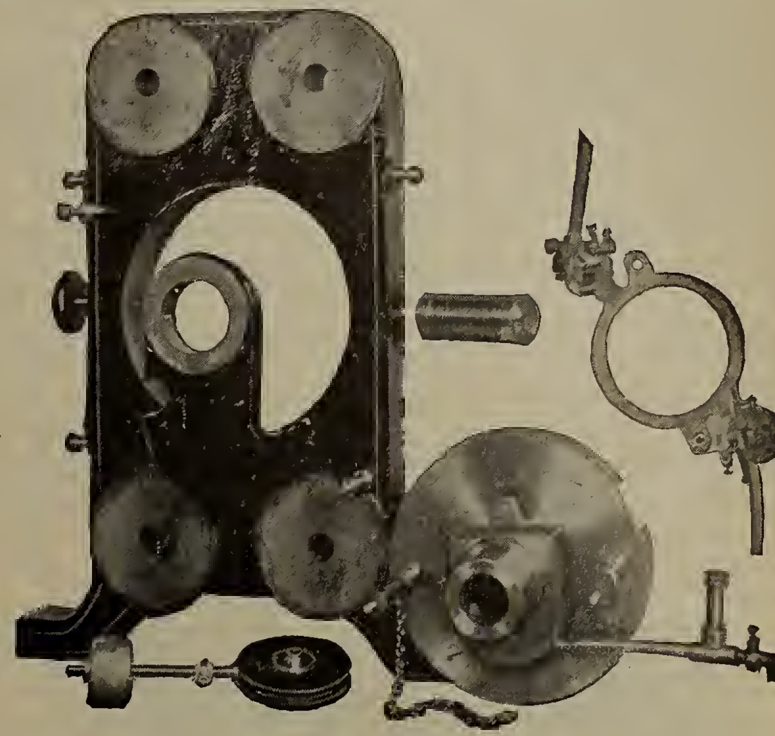


FIG. 5.

its action. Even with this modification it is so responsive that the feeding of a single lamp in circuit will cause the brushes to move.

The adjustment of the regulator to effect an increase or diminution of current is accomplished by the movement of the adjustable weight or ball, N′, out or in, on the threaded stem or arm, to increase or diminish the current as the case may be.

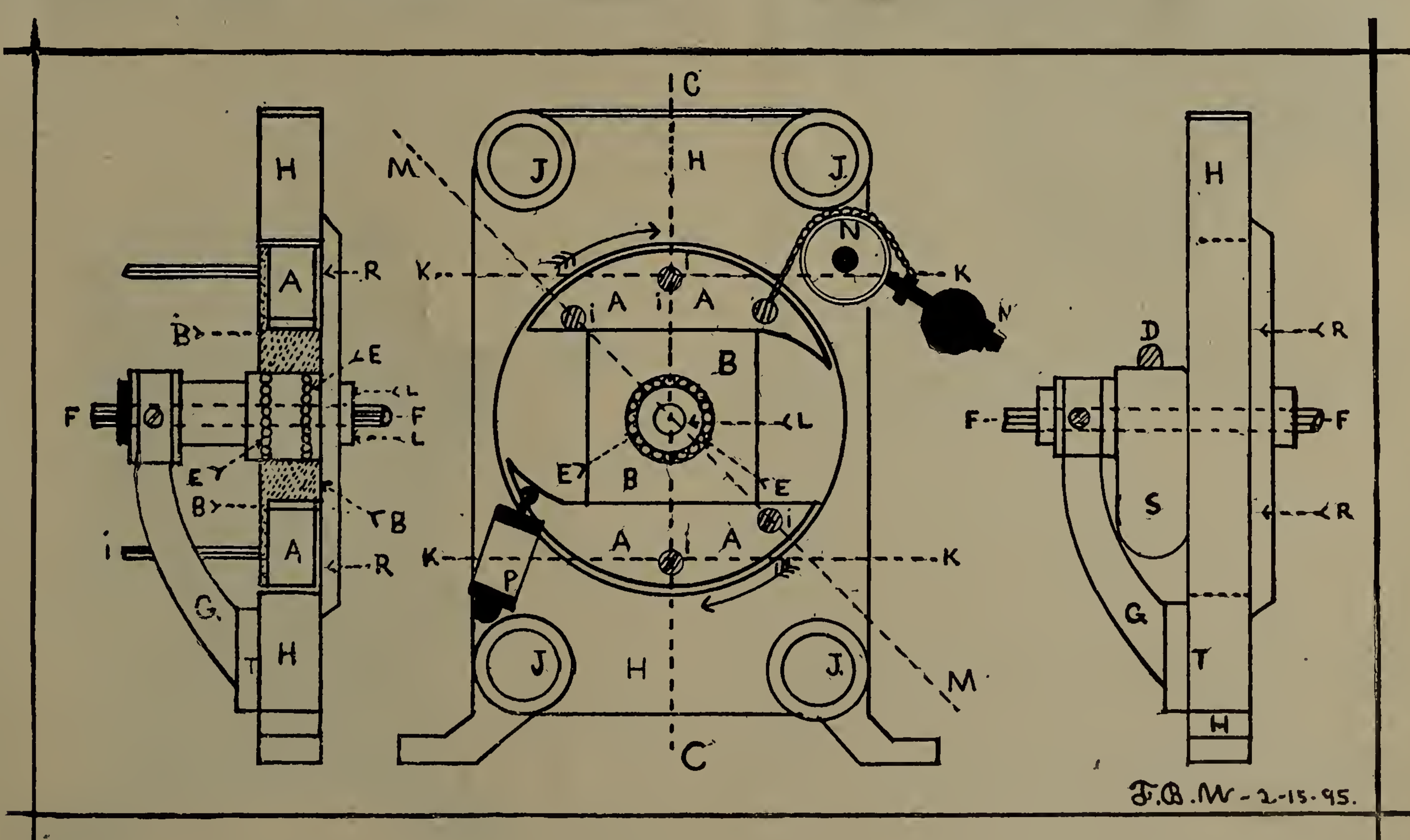


FIG. 3. FIG. 2. FIG. 4.

This new automatic dynamo has been in use for the past year in various places, and it has given entire satisfaction wherever installed.

The company has improved its system in various other details. All of its dynamos, from 15 horse-power up, are provided with a very simple self-oiling and self-aligning bearing, with inner support. (See Fig. 4).

This combination of regulator and bearing is so constructed that the two parts can be throughly inspected in a few minutes by the simple loosening of a couple of screws, allowing the removal of the back plate, R, and the whole bearing and regulator. H represents the end frame, R the movable back plate, S, the self-oiling bearing oiling reservoir, in which runs the lubricating ring, and G, the inner support cast on the end frame at T.

In coupling up the new style machine there are no loose wires or connections ; all couplings are made by neat cables coupled to well insulated binding posts or studs, which are mounted on the sides of the end frames, the workmanship being of the most substantial character.

Fig. 1 shows these couplings on a 100-lighter. The field coils are all wound on metal detachable spools, which are thoroughly insulated in the best possible manner by mica insulation, so as to withstand a pressure of at least 10,000 volts.

The terminals of the fields are connected with a short-circuiting switch. The armatures on all dynamos over 50 lights are insulated with silk and mica, and the construction and mounting is such that it is impossible for any part of the windings to become grounded with the core, or the dynamo shaft and frame.

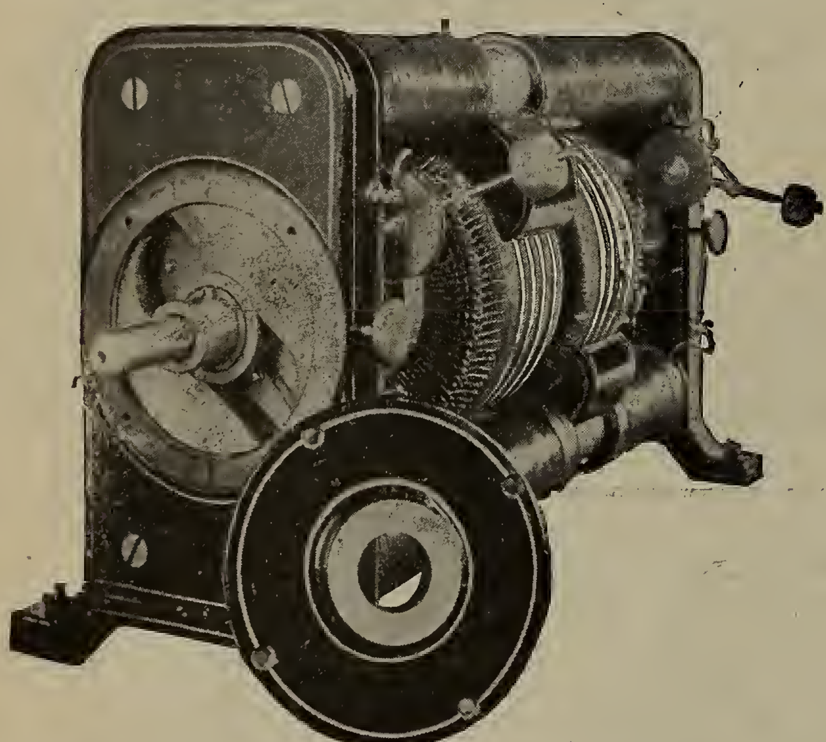


FIG. 6.

The Ball Company's well-known arc lamp has also been very much improved with an entirely new mechanism. The new movement is much simpler and more efficient than the old. The side rods of the out-door lamps have been strengthened and are heavily japanned. The automatic cut-out has been likewise improved; indeed, in every detail of the Ball system—lamps, dynamos, etc., all possible improvements have been effected. The company is getting out a new style ammeter.

The Ball Company has also introduced a single carbon all-night lamp of simple construction, which offers all the advantages of the double, triple, or disk lamps, with none of their many complications or defects. This company makes the simplest, most effective and practical arc lamp in the market—of the rack type—every movement of which is direct and positive and dependent upon the two well-known natural forces of nature—electricity and gravitation—without the use of a dash-pot or spring of any kind. These lamps are made of any candle-power and to run on any constant current or constant potential circuit. Enclosed globe lamps of fanciful design, for show windows, etc., are also made by the company. Figures 5, 6 and 7 show the relative arrangements of the regulator parts on the end frames.

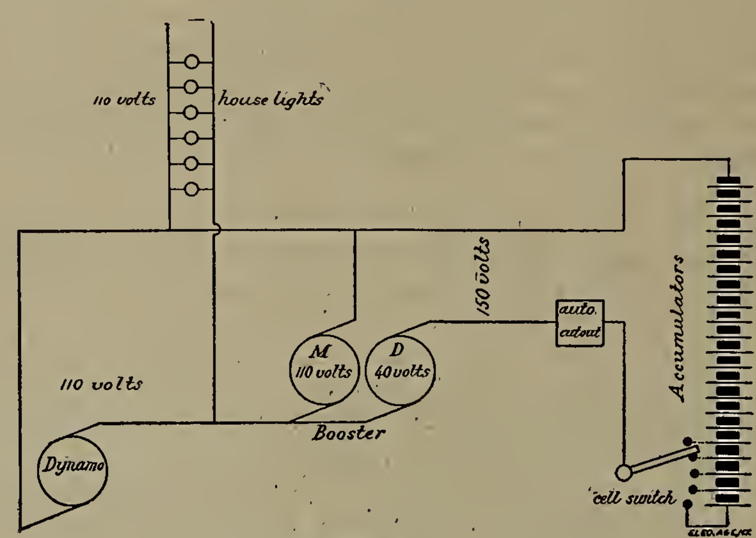
—Constant current machines are made of an output up to as many as 200 arc lights—about 10,000 volts and 9 amperes, or 90 kilowatts capacity. But such large machines are exceptional.

ACCUMULATOR-BOOSTER PLANT IN MONTREAL.

BY ERNEST W. SAYER.

At the Royal Victoria Hospital in this city is an interesting plant used for lighting the building.

Heretofore the lights have drawn their current directly from a plant of accumulator cells installed by the Montreal Electric Co., for the local representative of Crompton & Co., of London, Eng., Mr. John Forman. The dynamo



ACCUMULATOR BOOSTER PLANT.

was used exclusively in charging the accumulators, the machine being speeded up to the necessary voltage, which, of course, was too high for the lights.

It became desirable to light the building and charge the accumulators at the same time, and in order to do this successfully it was decided to install a "booster." The results have been highly satisfactory, and now both operations are carried on independently of each other withou any undue strain on any part of the system.

The accompanying diagram shows the connections of the system. The dynamo runs at its normal speed, generating 110-volts for the lighting circuits. Between the lamp circuit and the accumulator plant the "booster" is

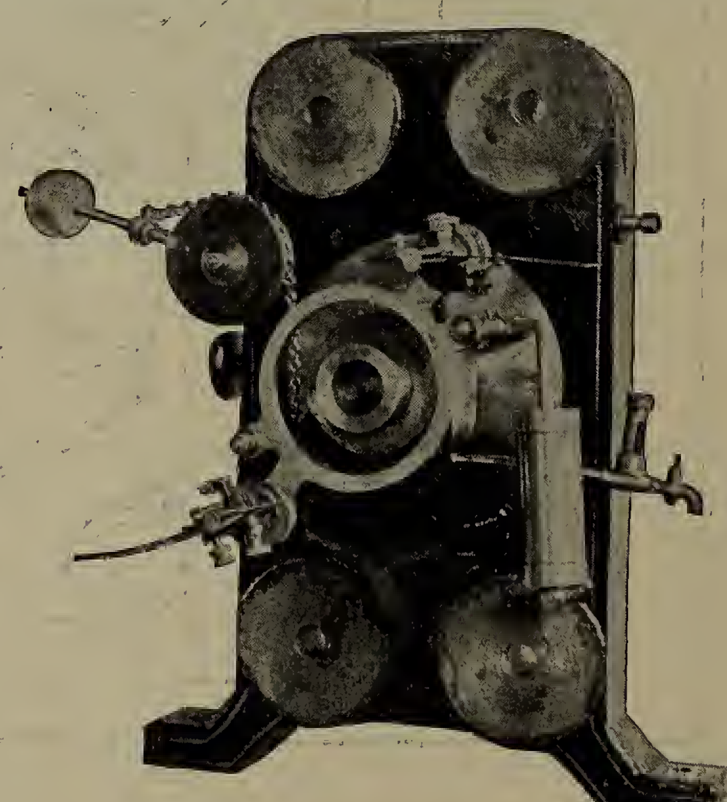


FIG. 7.

connected in multiple, one brush of the "booster" motor being connected with one of the mains and the other brush of the motor, and one brush of the "booster" dynamo making a common connection with the other main. The second brush of the "booster" dynamo is connected with the automatic cut-out and thence to the battery-switch.

The motor of the "booster," as will be seen, is operated by the 110-volt current, the dynamo section generating a

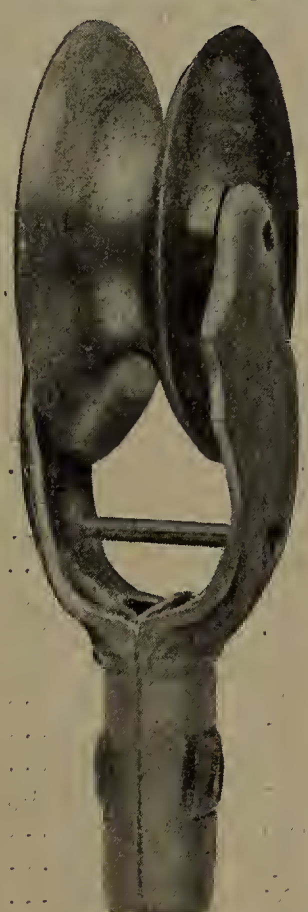
current of 40 volts, which reinforces the original 110-volt current. This reinforcement of current gives the 150 volts necessary to charge the cells.

The "booster" is so arranged that it can also be switched in on the three-wire bus-bars. It then supplies the booster current on one circuit, while the motor is run on the other. The batteries can also be discharged on either the two-wire or three-wire bus-bars. The normal current furnished to the accumulators is 50 amperes.

THE BACHE TROLLEY WHEEL.

The accompanying illustration shows a trolley wheel and harp that possesses some valuable features. It is Bache's patent, and is manufactured by the Graphite Lubricating Company, Bound Brook, N. J.

The hub of the wheel is fitted with this company's patent graphite and bronze bushings, which require no oil. In the hub of the wheel, around the outside of the bushing, there is a recess which contains dry, pure graphite in powder. The powder works through apertures provided for the purpose to the pin, making a perfect lubrication



BACHE TROLLEY WHEEL.

and compensating for the natural wear on the bushing. These bushings have been known to run 15,000 miles before being worn out.

The harp, or fork, is made in two pieces, which are held to the end of the pole by a single bolt. This bolt can be removed in a few seconds by an ordinary screw-driver. Thus a new harp or a new wheel can be easily put in at any point on the line of the road, the delay to the car not exceeding a few seconds.

The pin on which the wheel revolves is held in place without the use of nuts or cotters, which are always objectionable. There is nothing on the outside of the harp to catch.

The upper bolt of the harp is also removable with a screw-driver. It takes up wear, strengthens the harp and needs no contact springs. There is nothing to prevent the use of contact springs, however, should it be desired to put them in. If one side of the harp becomes broken it can be replaced without having to purchase a whole new harp.

The Graphite Lubricating Company also make these harps flexible, so that they will yield, more or less, when rounding curves, thus relieving the wire of much of the strain, and preventing much of the wear on the sides of the wheel-groove. These wheels give universal satisfaction..

This company manufactures, under letters-patent, graphite bushings, bearings and washers. They require no oil or grease for lubrication.

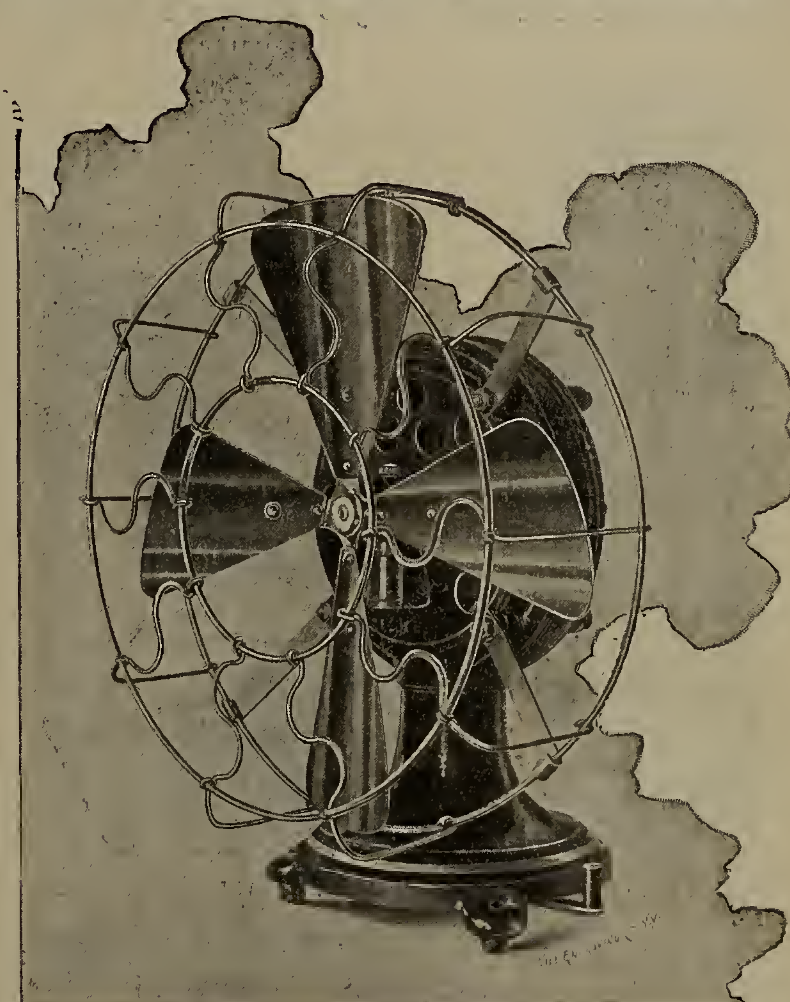
LUNDELL ALTERNATING FAN-MOTOR.

The Interior Conduit and Insulation Company, New York, is putting upon the market an alternating current fan-motor. It is of the well-known Lundell type, and is illustrated herewith.

In appearance the Lundell Alternating Fan-Motor outfit presents an equal beauty of design and finish to the direct current outfit, having a cylindrical field-magnet on a hollow cast-iron base. It is designed in two types, high frequency (14,000 to 16,000 alternations per minute) and low frequency (7,200 alternations per minute) at 52 and 104 volts.

Tests of the high frequency motors show that a current of 1.3 amperes, at 52 volts with 12″ fan, is a fair average for their operation.

Like the Lundell direct current motors they are superbly finished in rich black japanning, with gilt stripings. All



LUNDELL ALTERNATING FAN-MOTOR.

outside brass fittings, fans and guards, are either polished brass or nickel plated. Self-oiling and self-aligning bearings and a regulating switch, giving three speeds, are also features.

These motors are manufactured under the patents of Robert Lundell, by the Interior Conduit and Insulation Company, of New York City.

WHAT IS THOUGHT OF THE "ELECTRICAL AGE."

Philadelphia, April 10, 1895.

Electrical Age Publishing Company, New York :

Gentlemen—Enclosed please find $3.00 for renewal of my subscription to the Electrical Age for another year. I must confess that I get more business through your paper than any other electrical journal. I have secured many hundreds of dollars worth of contracts through your "possible contract" column. In my opinion the Electrical Age is invaluable to electrical people. Wishing you success, etc. Truly yours, —— —— ——.

THE ACME TELEPHONE.

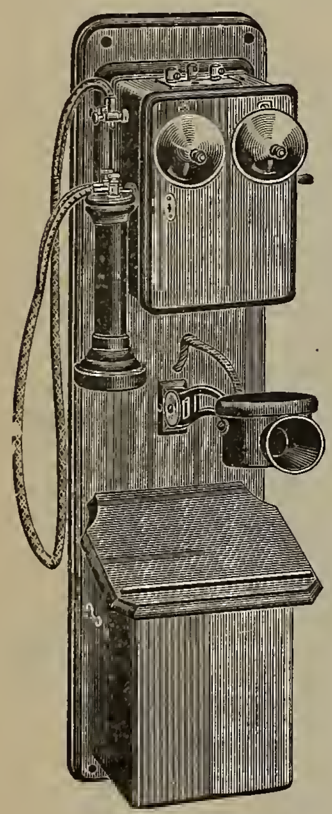
Among the best telephones that have come to the front lately is the Acme. It has made for itself an enviable reputation and it is rapidly expanding in use.

The Acme Telephone is the invention of Mr. Owen Moran, of No. 34 Broadway, New York. The instrument has been practically tested under all conditions and has given the very best of service. Mr. Moran, the manufacturer, claims that his telephone has great superiority over any other make of telephone in efficiency, simplicity, perfect articulation and workmanship, and is lower in cost; in short, it is said to be the cheapest and best telephone made, and will last a lifetime.

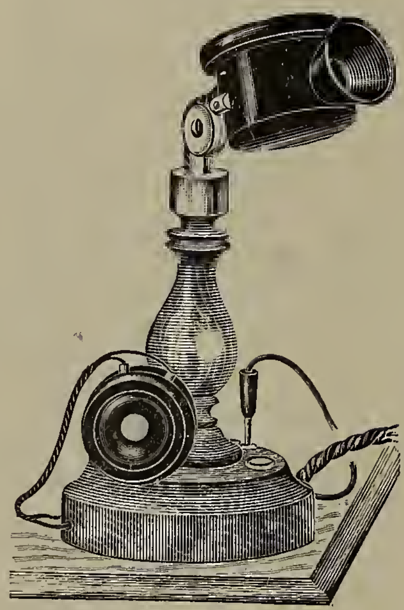
The Acme telephone is adapted for exchanges or private lines and will work perfectly at any distance up to 1,000 miles.

We give herewith illustrations of two styles of the Acme telephone, one (Fig. 1) the regular wall set and the other (Fig. 2) a portable desk set.

The wall set is made for central offices, private lines, railroad and other purposes. It will carry a whisper clearly and distinctly over a distance of 500 miles or more.



ACME TELEPHONE.



ACME PORTABLE DESK SET

The desk set is very convenient for table or desk, and can be made any size or design. The transmitter is the same as that used on the wall set.

These telephones do not infringe on other patents or rights of others. They are very simple in construction and require no adjusting. The electrodes are kept in their normal position by their own gravitation, and altogether are claimed to be the "acme" of telephone development. They are always reliable for long and short distances.

Acme telephones are used by the New York Central and Hudson River R. R. Co.; Arnheim, the tailor, New York, and the University of New York, where a complete system, including switchboard, is in operation. They are also used by Mr. Stetson, partner in President Cleveland's law firm.

There is a complete exchange of 100 Acme telephones in operation in Somerville, N. J., which is giving excellent service and satisfaction.

Mr. S. L. Simpson, 44 Broadway, New York, has taken the general agency for the Acme telephones. Mr. Moran, the inventor, will manufacture the instruments.

Published in Three Languages.—*Helios* is the name of a journal published in Leipzig, Germany, and devoted to the interests of the electrical export trade. It is printed in three languages, English, French and German. Hachmeister & Thal are the publishers.

TELEPHONE BUSINESS OF 1894.

The fifteenth annual report of the American Bell Telephone Company, submitted on March 26, shows that the licensees of the company during the year 1894 expended upon line extensions and apparatus, $4,138,000, and for buildings for exchanges, $411,000. This makes the total investment in telephone property in the United States $77,500,000.

The Long Distance Company, on December 31, 1894, had 4,617.24 miles of pole-line and cables, and 75,555.72 miles of wire.

Taking the entire country the average number of calls per subscriber per day is 17. "The great disparity in the number of calls made by the different subscribers in the same exchange who," the report says, "though paying the uniform yearly rate, require, in the transaction of their business, a widely varying amount of daily service, has led several of the companies, especially in the larger cities, to consider the adoption of a plan for measured service, of which advantage can be taken by the smaller users."

Plans of this kind have been adopted in New York, Boston, Brooklyn and other exchanges. The choice is offered to subscribers of paying the fixed yearly rate, with unlimited local service, or a graduated scale of charges, dependent upon the extent of use within the year, the cost per connection lessening with the increase in the number of calls for which contract is made.

Below is the schedule of rates now in force in New York city, which was adopted by the Metropolitan Telephone and Telegraph Company on March 27. These rates are for local messages over direct lines:

Messages.	Rate subject to rebate for unused messages.	Rate not subject to rebate for unused messages.	Extra messages each
1,000	120	...	8 cts
1,100	126	...	8
1,200	132	...	8
1,300	138	...	8
1,400	144	...	7
1,500	150	145	7
1,600	155	...	7
1,700	160	...	7
1,800	165	...	7
1,900	170	...	7
2,000	175	165	7
2,100	180	...	7
2,200	185	...	7
2,300	190	...	7
2,400	195	...	7
2,500	200	180	7
2,600	205	...	7
2,700	210	...	7
2,800	215	...	7
2,900	220	...	7
3,000	225	195	7
3,100	230	...	7
3,200	235	...	7
3,300	240	...	7
3,400	245	...	7
3,500	250	210	7
3,600	255	...	7
3,700	260	...	7
3,800	265	...	7
3,900	270	...	7
4,000	275	225	7

—The cost of fuel on the intramural road at the World's Fair was about four cents per train-mile on a 50-ton or 60-ton train, while on a steam railroad the same expenditure of fuel would haul a 500-ton freight train at the same speed, indicating that modern locomotives are doing about eight times as much work as the electric locomotive with the same fuel. A horse-power hour can be generated in a modern locomotive by the evaporation of from 25 to 28 pounds of water, and that, in average service, from 5½ to 6 pounds of water could be evaporated for each pound of coal.

EARLY HISTORY OF THE TELEPHONE.

Prof. D. E. Hughes, in reply to a toast, made some remarks at the banquet given in London, on March 15 last, by the staff of the National Telephone Company, on the early history of the telephone.

As these remarks are of special interest, we reproduce them herewith:

The earliest record of a perfect theoretical electric telephone was contained in Du Moncel's "Exposée des Applications," Paris, 1854; when M. Charles Bourseul, a French telegraphist, conceived a plan of conveying sounds and speech by electricity. Suppose, he explained, "that a man speaks near a movable disk sufficiently flexible to lose none of the vibrations of the voice, that this disk alternately makes and breaks the current from a battery; you may have at a distance another disk which will simultaneously execute the same vibrations." Unfortunately M. Bourseul did not work out his idea to a practical end, but in these few words we have the shortest possible explanation of the theory of our present telephones.

It is now exactly thirty years since my first experiments with a working telephone, for in 1865, being at St. Petersburg, in order to fulfil my contract with the Russian Government for the establishment of my printing telegraph instrument upon all their important lines, I was invited by His Majesty, the Emperor Alexandre II., to give a lecture before His Majesty, the Empress, and Court at Czarskoi Zelo, which I did, but as I wished to present to his Majesty not only my own telegraph instrument, but all the latest novelties, Prof. Philipp Reis, of Friedericksdorf, Frankfort-on-Maine, sent to Russia his new telephone, with which I was enabled to transmit and receive perfectly all musical sounds, and also a few spoken words, though these were rather uncertain, for at moments a word could be clearly heard, and then, from some unexplained cause, no words were possible. This wonderful instrument was based upon the true theory of telephony, and it contained all the necessary organs to make it a practical success. Its unfortunate inventor died in 1874, almost unknown, poor and neglected, but the German Government have since tried to make reparation by acknowledging his claims as the first inventor, and erecting a monument to his memory in the cemetery at Friedericksdorf.

The duties connected with my printing telegraph instrument prevented me from continuing my experiments with the telephone of Professor Reis; but in 1876 we heard in Europe of the invention, by Prof. Alexander Graham Bell, of his wonderful telephone, by means of which the practical transmission and reception of human speech had become an accomplished fact, and early in 1877 the instrument was brought to England. I at once resumed my experiments of 1865 with it, and found that Professor Bell's telephone, considered as a receiver, was absolute perfection, but that his mode of transmission of magneto-electric currents, generated solely by the movement of an iron diaphragm near its electromagnet, was defective, as the currents produced were too feeble for any practical use. I then tried to adopt Professor Reis's system of using a separate battery, brought into play by the movement of a diaphragm.

I will not cite the numerous experiments and difficulties that I met with in this research; but at last I succeeded in finding the effect I wished, by the use of a very slight electric contact of the surface of solid carbon, or any other metals, such as ordinary iron nails. This slight or microphonic contact has the remarkable power of varying the resistance, and, consequently, the force of an electric current, exactly in accordance with the sonorous vibrations of the human voice; and, in fact, the contacts could easily be rendered so sensitive that the instrument became a true microphone, rendering audible sounds far too feeble for the human ear. All these results I gave freely to the public, and brought before the notice of the scientific world in a paper I read to the Royal Society in May, 1878.

Another discovery which I made in the continuance of my researches, which is now of the highest utility to distant telephony, was the use of twisted wires, or wires so arranged upon their insulators that the whole line should gradually revolve on its axis, so as to prevent induction from other independent wires. This was given freely to the world in my paper read before the Society of Telegraph Engineers, March 12, 1879, and fully illustrated by engravings in *Engineering* of the same week. In order to understand this, I will quote a single paragraph from this paper:

"If two ordinary aerial lines are thus used, they should have the twist given to these wires by changing their position relatively to other wires from vertical to horizontal at each pole or mile. Thus, if we had two lines, A and B, they should have their four relative positions repeated as often as possible—viz, A B, then $\frac{B}{A}$; then B A and $\frac{A}{B}$,,

This is the system employed by the telephone line between London and Paris, and, in fact, upon all successful long-distance telephone lines throughout the world, so I think it is only fair that it should be known that I discovered and published this long before long-distance telephony was ever brought into use.

During the same months of 1877 that I was experimenting with Prof. Bell's telephone, Mr. Edison in the United States was also engaged upon a similar research—viz., endeavoring to adopt Prof. Reis's method of transmission by a diaphragm and separate battery, and he succeeded in inventing and patenting his form of transmitter, which he called the carbon telephone. This transmitter was brought to England in 1878, and it worked remarkably well, although I felt convinced then, as I am still, that the theory upon which it was supposed to work was wrong. Mr. Edison's views were that its mode of action was based upon the varying resistance obtained through a varying pressure of the diaphragm upon an elastic button of carbon. (He believed that the varying resistance of carbon by pressure was an original discovery, but it was well known for many years previous in Europe through its publication by Du Moncel, and its application by Clerac in his carbon resistance tube, whose resistance was varied according to the pressure given to its adjusting screw.) The error of this theory is shown by the fact that we cannot obtain more than a difference of resistance through pressure upon any conducting substance but of a few ohms, say one to ten, but with a microphonic joint we can easily obtain the widest possible range, from almost zero to an infinity of resistance, and this with the smallest possible expenditure of mechanical energy from the diaphragm, or even without a diaphragm. I believed then, as I do still, that its excellent functions were due to a microphonic joint, of which, and of the value of which, he was unaware, and I also believe that the often successful transmission of words by Prof. Reis's transmitter was due to an accidental adjustment of his contacts to a true microphonic condition. He was, of course, unaware of the power and importance of microphonic joints, else his telephone would have been a practical success at once.

Unfortunately, Mr. Edison and myself had a painful discussion as to priority of invention, in which we have both sustained our individual views up to the present time. Mr. Edison's views have been sustained by all the companies owning his patent; mine have been sustained by nearly the whole scientific world. The companies, however, whose interest it was to sustain and possess for themselves an entire monopoly, have spared neither wealth nor power to obtain this coveted monopoly, and by the means of the ablest legal counsel and expert witnesses they obtained a legal decision giving them the sole right to the use of a diaphragm pressing upon a variable resistance, notwithstanding that the diaphragm was the discovery of Prof. Reis and microphonic contact by myself.

This is all now past history, but I am now more than consoled by the fact that at the present time there is not a single transmitter in practical use throughout the world whose function is not based entirely upon its microphonic joints, whether in the form of solid conductors pressing upon each other, or when these contacts are multiplied as in the form of granules or powder.

OBITUARY.

GEORGE MAY PHELPS.

The electrical fraternity was painfully shocked by the announcement of the death of Mr. George M. Phelps, in Brooklyn, N. Y., on April 11, from pneumonia.

Mr. Phelps was born in 1843, in Troy, N. Y., and was the son of the late George M. Phelps. He received a public school and high school education in his native town.

Since 1861, excepting an interval of five years, he was continuously engaged in electrical interests; first in the shop of The American Telegraph Co., of which his father was superintendent from its organization till its absorption by the Western Union Co., in 1866, and afterwards, from 1863 to 1866, in the Auditing Department of the American Telegraph Co. From 1871 till 1879 he was assistant to his father in the management of the Western Union Company's factory in New York, and when in April of the latter year the telegraph company gave up its own manufacturing and disposed of its factory to the Western Electric Co., he was appointed superintendent of the factory by the latter company. He held this position till December, 1885.

Early in 1886, Mr. Phelps joined Mr. Franklin L. Pope in conducting *The Electrician* and *Electrical Engineer*, then published monthly, acquiring a proprietary interest in that journal soon after. When the *Electrical Engineer* was expanded to a weekly and its business incorporated, he became and was at the time of his death president of the corporation.

Mr. Phelps was a charter member of the American Institute of Electrical Engineers, and was elected one of its managers on May 19, 1885. He served on the Council in this capacity until his election as treasurer on May 17, 1887, to which office he has since been re-elected each year, and which he held at the time of his death. He had been nominated for the same office by the Council for the term beginning May 14, 1895.

THE BELL TELEPHONE PATENT SUITS

In the annual report of the American Bell Telephone Company for last year reference is made to the patent suits.

The suit of the United States vs. the American Bell Telephone Company and Alexander Graham Bell, the report states, still remains pending, notwithstanding that the two Bell patents, No. 174,465, of March 7, 1876, and No. 186,787, of January 30, 1877, which it was brought to annul, have both expired.

Owing to unavoidable interferences and to the illness of counsel for complainant, the time for taking defendant's evidence has been extended to June 12, 1895.

The suit of the United States vs. the American Bell Telephone Company *et al.*—the Berliner suit, so-called—was argued June 14–20, 1894, before the Circuit Court. The court, on the 18th of December, 1894, rendered a decision that the patent was void. An appeal has been taken to the Circuit Court of Appeals, and the cause is expected to be argued next month (April).

In the Western Union Telegraph Company vs. the American Bell Telephone Company it will be remembered that a decree was made by the Circuit Court allowing the motion of the plaintiffs to dismiss their case without prejudice. This motion was made upon the coming in of a report of the master finding that the plaintiffs were not entitled to the account asked for. An appeal was taken, and the decree of the Circuit Court has been reversed by the Court of Appeals, the case being remanded to the Circuit Court for further proceedings.

In the thirteenth annual report it was stated that Edison's application for a patent for the carbon telephone had resulted in patent No. 474,231; but it was said:

"It is necessary to add, however, that Edison's foreign patents for the same invention, although applied for subsequently to application in this country, had expired previously to the grant of the American patent. Our counsel inform us that the law is unsettled, whether in such cases the American application should be defeated by the expiration of the foreign patent, but that the better opinion is that the expiration of the foreign patent is immaterial."

The question involved has recently been determined by the Supreme Court in the case of Bate Refrigerator Company vs. Ferdinand Sulzberger, *et al.*, which holds in substance that the domestic patent in such case is determined by the expiration of the foreign patent, notwithstanding that the domestic application is earlier than the application for the foreign patent. The result of the decision is to annul the Edison patent.

TELEPHONE STOCK-JOBBING.

The daily press of this city has lately printed highly colored articles concerning the great reduction in prices of telephones, which certain companies proposed to effect. In order to verify or disprove the accuracy of these tales a representative of the ELECTRICAL AGE attempted to investigate the matter, but could not get any more definite information concerning the plans than what was contained in the articles referred to. These articles hinted at the interest some mysterious "great man" had in the enterprises, and to enhance the effect of the appeal for financial support great stress was laid upon the probable vacating of the Berliner patent and the methods of the "grinding monopoly—the Bell Telephone Company." Not being able to learn anything in this direction about these much-vaunted schemes, our representative interviewed several well-known and reputable persons who are authorities on telephone matters, and whose word and opinion are worthy of careful consideration. All of these gentlemen characterized the stories about the so-called cheap telephone service as stock-jobbing deals. As corroborative of the truth of these assertions they referred to the difficulty our representative experienced in trying to learn something about these companies that proposed to smash the rates to flinders.

There is no occasion for the investing public to go into these schemes when there are plenty of legitimate telephone companies that are worthy of attention. These companies are in the field prepared to do business on business principles. Among them may be mentioned the Public Telephone Company, of New York; the Western Telephone Construction Company, Chicago; the Auto-Telephone Company, of New York; the Universal Telephone Co., Indianapolis, Ind.; The Phœnix Interior Telephone Company, New York; O. Moran, New York; De Veau & Co., New York, and the Columbia Telephone Company, New York. Ex-Senator Wallace, who is a director of the last-named company, is a lawyer of high repute and one of the few who are thoroughly posted on telephone patents and practice. The Metropolitan Telephone Company, of New York, will sell telephone outfits to anyone for private or public use; so, after all, it will be seen from what has been said that the telephone field is well taken care of and that prices are as low now as one could reasonably expect them to be.

ELECTRIC RAILROAD IN THE "ETERNAL CITY."

At the present time omnibuses and a few horse cars constitute the principal means of travel in the streets of Rome. A concession has, however, just been granted to the Societa Romana degli Omnibus for the building of an electric road to run from the general post-office to the principal railroad station in that city. Grades of considerable size will have to be overcome. The overhead Thomson-Houston trolley system will be adopted, and it is expected to have the line open for business on September 17, of this year.

THE AUTO-TELEPHONE SYSTEM.

A telephone system that has come into prominence of late is the "Auto-Telephone" system, of which the Tucker Electrical Construction Company, 14–20 Whitehall street, New York, is sole licensee.

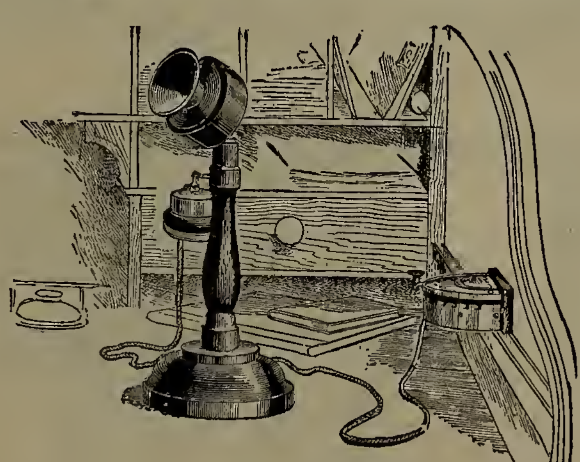
This system is designed to overcome the objections

AUTO-TELEPHONE.

heretofore urged against interior systems, and is an ideal of its class.

By the use of this system every department of a business establishment is under instant control of the manager, and orders can be given and consultations had with the heads of the different departments as easily as if the parties were face to face.

Flexibility is one of the main features of the system. When desired, the system may be arranged so that certain stations only can call a given station, although it is possible for the said station to call each and all of the others. The practical value of this feature is exemplified where the manager of an establishment is enabled to reach every instrument on the system, yet only certain instruments can call him—those of superintendents of departments, for instance. And yet the system is so flexible



AUTO DESK TELEPHONE.

that it is possible to arrange it so that any station can communicate with any other in case of emergency.

The Auto system is practically automatic, and has but one battery source. Two or more pairs of instruments may converse at the same time without interference, and by the employment of a key, any one station can be placed in speaking relation with any other.

The call signals operate both the calling and receiving instruments at the same time, and when the call operates, it is a sure test that the circuit is intact. This system is especially adapted for the requirements of hotels, public institutions, clubs, vessels, business offices, factories, stores, private dwellings, etc., and is a great economizer of time and money. The instruments and system are sold outright.

The Tucker company has lately added some improvements to the instrument that adapt the system to long-distance work. Two instruments were connected through a circuit of 3810 ohms resistance and conversation was carried on in a most satisfactory manner. The resistance consisted of ten-16 c. p. lamps of 115 volts each, and equalled a metallic circuit of 900 miles, equivalent to the distance between New York and Chicago. The voice of the speaker was received clear and distinct. This was an unusual test, but the instrument proved its worth.

The Auto-Telephone instruments are beautifully finished in ebonized wood and nickel, and are rapidly growing in favor.

FINE INDUCTION COILS.

The rapidly expanding telephone business is giving the manufacturers of telephone apparatus plenty of work.

Mr. C. F. Splitdorf, of 17 to 27 Vandewater st., New York, makes a specialty of telephone-transmitter coils of high quality. These goods as made by him are conceded to be the best in the trade, and the fact that he makes large numbers of these induction coils for the largest telephone manufacturers is evidence of the high class of work put upon them.

Mr. Splitdorf, however, does not confine himself to making induction coils alone, although this particular work is

INDUCTION COIL.

a very important branch of his business. He makes as well electro magnets, telephone bobbins, bell-magnet bobbins, spark coils, arc-light spools and motor armatures. He has a large shop, equipped with modern tools and machinery, and has every facility for turning out large orders with dispatch. His establishment is kept running to the top notch all the time.

FOREIGN NOTES OF INTEREST.

The telephone system of the Vienna Private Telegraph Company, Vienna, Austria, has passed into the possession of the government.

An international exhibition will be held in Brussels in 1897. It will open in May, and continue for six months. Electricity will form a prominent feature.

In a recent report to Parliament concerning the British telegraph service, the ratio of expenditures to revenue is shown to be a constantly increasing one. In the year 1870–71 this is given as 59.57 per cent., in 1875–76 as 85.96 per cent., in 1880–81 as 80.08 per cent., in 1885–86 as 102.52 per cent., in 1890–91 as 97.22 per cent., and for the year 1894–95 it is estimated at the figure of 109 per cent.

The telegraphic and telephonic cables between London and Paris have, within the last month, been so blocked with messages as to considerably interfere with the business which is carried on daily between the two capitals. A telegram from London to Paris, sent during the day, often takes from one to three hours to reach its destination, while those anxious to use the telephone are obliged to take a turn which may reach them in two or three hours after the communication has been asked for. Under these circumstances business in several branches of trade has become almost impossible between Paris and London.

It is stated that the two Heilmann locomotives now being constructed for the Western Railway Company of France, for express service between Paris and Dieppe, are to be ready next June.

On July 1 next a telephone line will be opened between Holland and Belgium.

The Faraday medal of the Chemical Society has been conferred upon Lord Rayleigh in recognition of the investigation which has led to the discovery of argon. The previous recipients of the Faraday medal are Dumas, Canizzaro, Wurtz, Helmholtz, and Mendeleeff.

PHŒNIX INTERIOR TELEPHONE.

This telephone is one of the most serviceable instruments on the market. It is adaptable to connecting house and stable, house and office, different parts of a house, factory or warehouse, and for local exchange work.

The instruments are sold outright, and the aim of the independent switch system, as many as 50 instruments can be independently connected without the use of a central station; be all inter-communicating, and all able to talk at once without interference.

The battery telephone, fig. 3, has a nickeled bell or buzzer, and is adapted for lines of not over 600 feet in length. It is an excellent instrument for private house use, and is well made. Fig. 4 shows the Blake transmitter as made by this company, and fig. 5 shows the desk telephone. The transmitter is of the company's watch-case pony Blake style, in nickeled case, watch-case receiver, etc., etc. The cords run to the call-bell and push-button box which lies on the desk. This little box contains the bell, buttons, and induction coil and can be used as a paper weight.

This outfit is claimed to be the most convenient of any

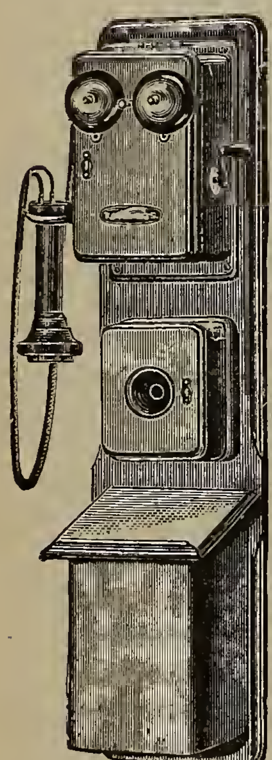


FIG. 1.

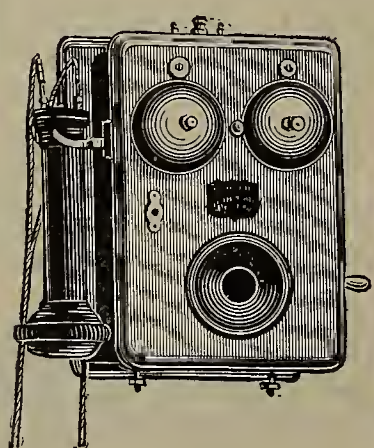


FIG. 2.

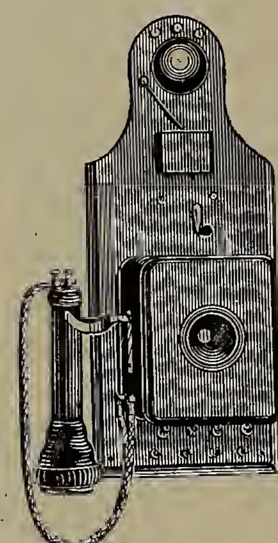


FIG. 3.

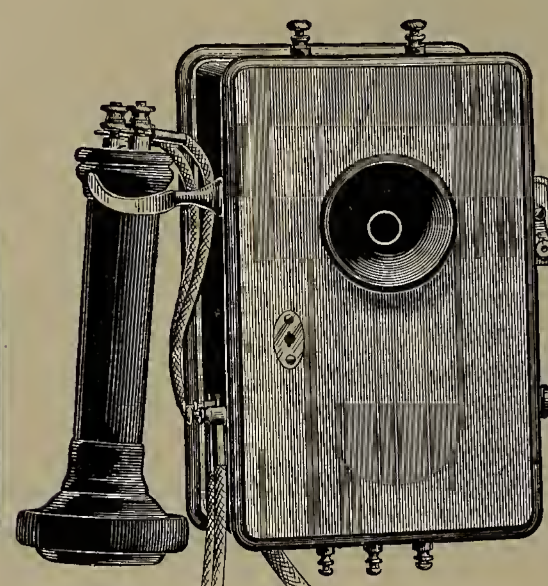


FIG. 4.

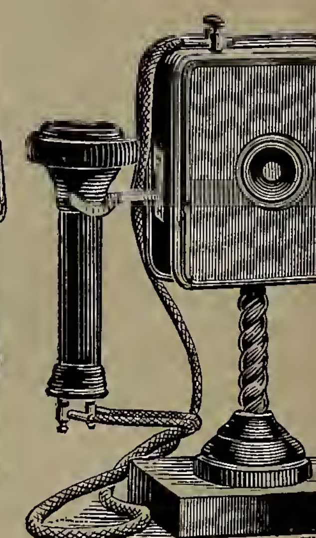


FIG. 6.

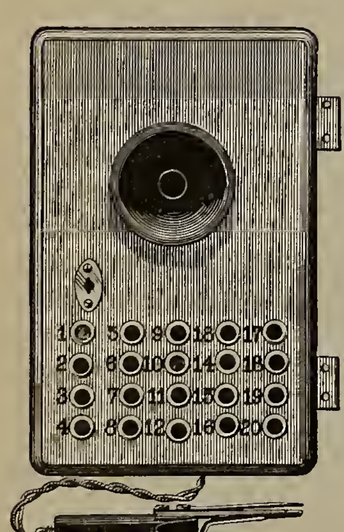


FIG. 9.

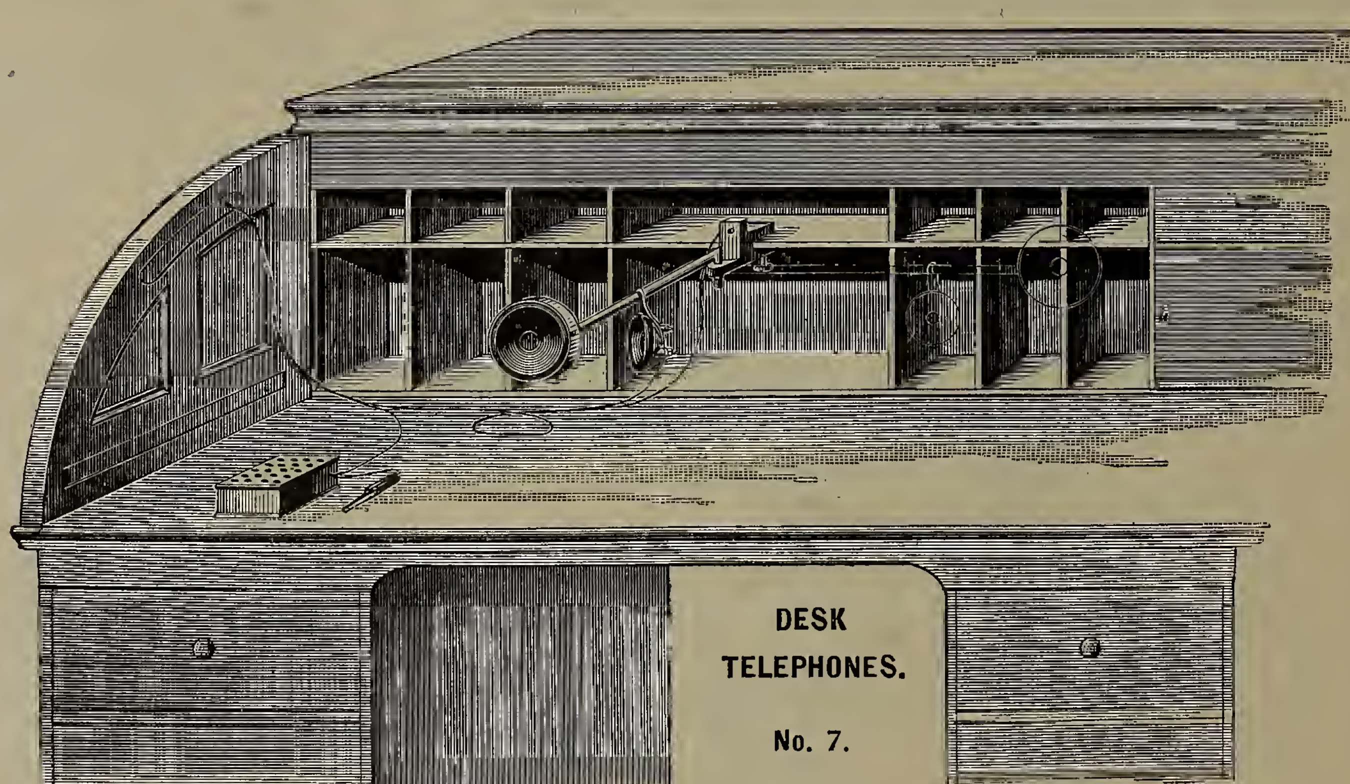


FIG. 5.

manufacturers is to "furnish the best telephone in the market at reasonable prices."

The Phœnix Interior telephones are made by the Phœnix Interior Telephone Co., 131 Liberty street, New York. This company makes telephones of all styles for all purposes and uses.

Fig. 1 shows the regular main line Blake telephone, with standard magnets, Blake transmitter, receiver, cord and battery box complete. The company claims to make the best Blake transmitter in the market.

Fig. 2 is a view of a Blake transmitter with magneto call-bells. It is designed for interior work for distances over 200 feet. It is especially recommended for factory use, and when fitted up with the Phœnix Interior Company's made. It is designed to clamp on any of the partitions of the desk, and when not in use to be swung back out of the way, thus cutting out the instrument. This instrument is guaranteed to talk over long or short distances equally well.

Another form of desk telephone is shown in fig. 6. The apparatus is mounted on a brass standard and can be moved about at will.

The Watch-case Pony Blake transmitter is shown in fig. 7. This instrument is small but as serviceable and efficient as the full-sized standard instrument.

The Watch-case Receiver is illustrated in fig. 8. This receiver is, like the Pony transmitter, small in size but is very powerful and guaranteed to give satisfaction.

Fig. 9 gives a view of the Phœnix Interior Company's Independent Switch System. Each eyelet represents a station and any station can be communicated with by inserting the plug in the proper place on the switch. When not in use the plug is allowed to drop down, which places the instrument in such relation with the system that it can be called

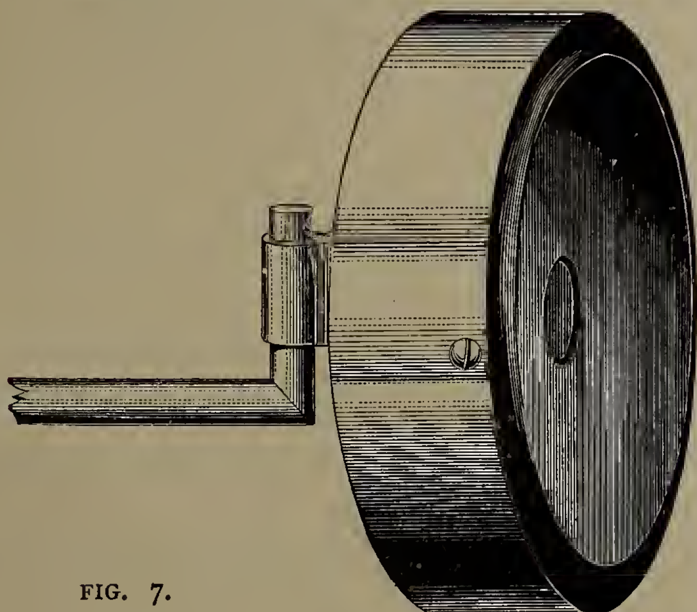


FIG. 7.

by any station thereon. It is an excellent instrument for store, warehouse and factory use.

For central stations the switchboard illustrated in fig. 10 is designed. This instrument is non-infringing, and is made with any number of drops and for either ground or metallic circuit.

The Phœnix Interior Telephone Company manufactures all telephone apparatus, and its instruments are meeting with much commendation.

THE STANDARD UNDERGROUND CABLE COMPANY.

This company has installed a number of underground cables for light and power purposes in the principal cities in the United States, but the slickest job was done for the West End Railway Company, of Boston. A competing company believed that it had secured the contracts for all

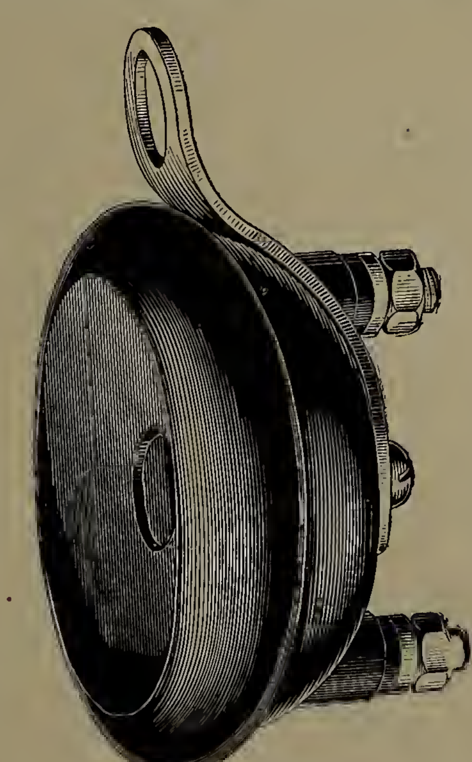


FIG. 8.

the underground cables for the West End Company, but the Standard Company had quietly secured a share of the work. They brought the large cable called for in the contract, and in a very matter-of-fact way placed it in the conduits along side of the cable being installed by their competitors, and then retired. Mr. Geo. L. Wiley, the manager of the Standard Company's New York office, got this contract. He is a very successful business getter.

CREDIT TO WHOM CREDIT IS DUE.

In our issue of April 13 we published a short article regarding two portable electric light plants constructed for Buffalo Bill's "Wild West" show. The name of the builders was inadvertently omitted. It should be stated that Ridsdale & Lewis, dealers in machinery and supplies, 39 Cortlandt street, New York, were the successful competitors for the construction of these novel electric light plants. Mr. T. A. Lewis, of the firm, drew the complete plans for these plants, overcoming many difficulties which had hitherto been considered unsurmountable.

These two plants are fine examples of mechanical and electrical engineering skill, and said to be the only ones of the kind in existence. They were given a thorough practical test, and they exceeded the contract requirements.

These plants are to be used in lighting the grounds occupied by the "Wild West" show at the various cities

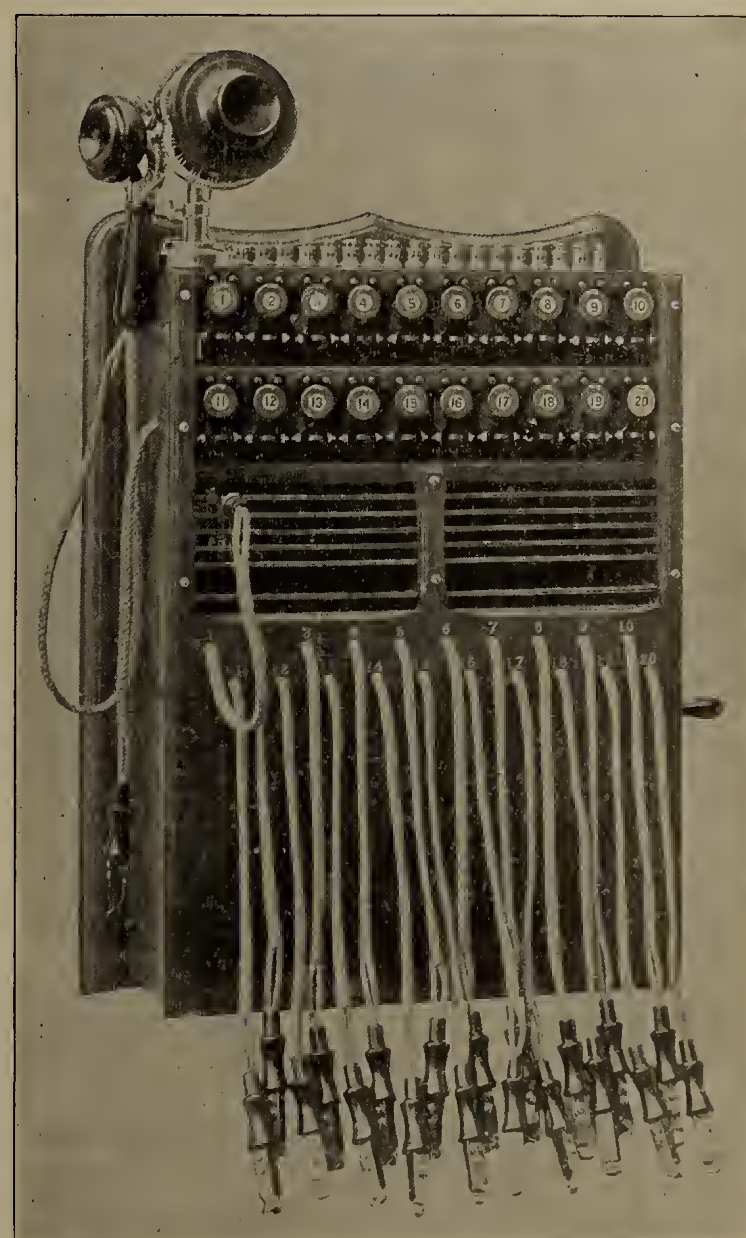


FIG. 10.

where they will exhibit. In their construction Ridsdale & Lewis were furnished with the different parts of the plant, as follows: Dynamos, by the Ball Electric Light Company, Ninth avenue and Twenty-seventh street, New York; trucks, by the Sebastian Wagon Co., New York; Clapp & Jones' boilers, with copper tubes, built under the supervision of Ridsdale & Lewis; two 25-H. P. Case engines, and L. P. D. transmitters.

Climax Boilers.—In our article last week about the reception at the Brooklyn Edison Illuminating Company's station a typographical error made the total horse-power of Climax boilers installed last year in electric light and power plants alone as 10,000. The figures should have been 50,000 H. P.

Frank C Dumas.—Several letters have reached this office addressed to Frank C. Dumas, care of Electrical Age. We are holding them for that gentleman.

MR. FOOTE'S LATEST WORK.

We have received from G. P. Putnam's Sons, the publishers, 27 West 23d street, New York, a copy of Mr. Allen R. Foote's book entitled "A Sound Currency and Banking System: How it may be Secured."

The work is addressed "To the Sufferers from the Panic of 1893," and is an argument in favor of a properly appointed monetary commission to devise a sound currency and banking system that will remove the causes of financial panics.

The author is well known to electrical people and is a recognized authority on questions pertaining to the economic problems of the day. This work is a dignified plea for a sound currency and banking system, and will unquestionably exert a great influence on the minds of those who are students of the questions involved. The price of the book is 75 cents.

New Corporations.

The Southern Standard Telephone Company, Louisville, Ky. Capital stock, $4,000,000. Thurlow Weed Barnes, of New York, is president.

The Central Standard Telephone Company, St. Louis, Mo., by Griffith Colt. Capital stock, $5,000,000.

American Telephone and Telegraph Company, Richmond, Va., by Ed. P. Meany, of Newark, N. J.; Melville Egleston, Elizabeth, N. J.; Edward J. Hall, Chas. R. Bangs, of New York, and George Wayne Anderson, of Richmond.

The Middlebrook Telephone Company, Staunton, Va., by John H. Bowan, J. Frank Clemmer, H. A. Shepherd, W. W. Sproul, J. F. Clemmer, William McComb, H. M. Clemmer, C. S. Condon and W. C. Bosserman. Capital stock, $5,000.

The Rondout and Eddyville Railroad Company, Eddyville, N. Y., by Wm. T. Hiscox, Percival E. Smith and others, of New York City. Capital stock, $30,000.

Empire State Electric Forging Company, Syracuse, N. Y., by L. H. Groesbeck, C. M. Warner, of Syracuse; J. O. Adsit, of Hornellsville; D. E. Mosely, of Rochester, and E. D. Woodruff, of Auburn.

The Manhattan Automatic Fire Alarm Company, Newark, N. J., by Chas. A. Hanson, of East Orange; John B. Gould, of Brooklyn, and H. L. Washburn, of New York. Capital stock, $100,000.

The Bernatz Telephone Company, Helena, Mont., by G. G. Beckwith, W. B. Hundley and F. Bernatz. Capital stock, $5,000.

The Cleveland, Painesville and Eastern Railroad Company, Cleveland, Ohio, by Henry A. Everett and others. Capital stock, $350,000.

The Pittsburgh Connecting Railroad Company, Pittsburgh, Pa. Capital stock, $200,000.

The Peoples' Telephone Co., New Haven, Conn., by Ex-Governor T. M. Waller, J. E. Boles, J. Irving and J. J. Lawton. Capital stock, $500,000.

The White Bear Telephone Co., St. Paul, Minn., by John L. Pratt, of Chicago, and Jas. L. Brass, Jas. Berlingett, Tracy Lyon and Robt. C. Wright of St. Paul. Capital stock, $10,000.

The Universal Telephone Co., Indianapolis, Ind., by E. B Charles, Robt. Martindale and others. Capital stock, $25,000.

The Middletown and Bloomsburg Electric Railway Co., Albany, N. Y., by J. C. Hinchcliffe and John Hinchcliffe, of Paterson, N. J.; W. B. Rockwell, of Scranton, Pa., and E. G. Wightman, F. D. La Bar, C. H. Smith, A. E. McIntyre, W. B. Royce, and W. H. Wiggins, of Middletown. Capital stock, $200,000.

Possible Contracts.

The Windsor Locks Telephone Co., Windsor Locks, Conn., has a large force of men at work erecting new lines in that place.

The Christian County Telephone Co., Springfield, Mo., is making good progress in the construction of its lines from Ozark to Springfield.

The Athens Street Railway Co., Athens, Ga., has purchased a water-power franchise and will use the same for the generating of electric power. Work will be commenced at once on the enterprise.

N. Purdum & Co., hardware dealers, Chillicothe, Ohio, propose to add an electrical department to their business, and will carry a large line of electrical supplies.

W. D. Davis, Statesboro', Ga., will erect an electric light plant in that place.

Chas. H. Barrett, of Philadelphia, Pa., and others, will erect an electric power plant at Ocean View, Va., to cost $80,000.

The Consolidated Electric Light Co., Birmingham, Ala., contemplates building an electric light plant.

The St. Charles Street Railroad Co., New Orleans, La., will build an electric power plant to cost $70,000.

The New Orleans branch of the New Standard Telephone Co. has been organized under the name of the Gulf States Standard Telephone Co. by A. A. Maginnis, president; W. J. Behan, vice president, and Harry Allen, general manager.

L. E. Drake, Anderson, Ind., is at the head of a project to form a new telephone company in Memphis, Tenn.

The Interstate Telephone and Telegraph Company, Durham, N. C., will build exchanges in Gordonsville and Charlotteville, Va. Also one in Orange Court House, Va.

An electric railroad is to be built from Rossville to Chickamauga, Tenn. D. W. Steward and others are interested.

Martin & McKown, Wheeling, W. Va., will shortly need some machine tools.

Machine tools are wanted by A. B. C., 378, care of the *Sun* office, Baltimore, Md.

M. B. Rice, superintendent of the Capital City Telephone Co., Tallahassee, Fla., wants bids on forty telephones and apparatus for an exchange of fifty subscribers.

An ordinance has been introduced in the City Council, Pittsburgh, Pa., requiring all electric wires within the city be laid underground. The clerk of the City Council may be addressed for further information.

It is reported that the railroad between Annapolis and Bay Ridge, Md., will be changed to the trolley system. Nelson Perin, care of the City and Suburban Railroad Co., can give further particulars.

The Frankford and Southwark Railroad, Frankford, Pa., will probably be extended. Address the superintendent of the company for further information.

The extension of the Durkirk and Fredonia Street Railway, Dunkirk, N. Y., is contemplated.

The Norwalk Lock Company, Norwalk, Conn., will build a large addition to its works, and introduce modern machinery and conveniences.

Address B. W. Hencke, Longwood, Fla., concerning three electric power plants to be installed.

A large hotel, to cost $3,000,000, is to be erected in Boston, Mass. Balch & Rackemann are the architects.

The Houston Rapid Transit Co., Houston, Texas, will extend its lines to the race-course.

It is reported that Abram S. Hewitt, of New York, intends to introduce electricity as the motive power on the New York and Greenwood Lake Railroad.

New York Notes.

Office of the Electrical Age,
World Building, New York,
April 15, 1895.

The Bridge Publishing Company, World building, New York, has just issued an interesting little pamphlet giving a history and description of the great Brooklyn bridge.

The Knapp Electric Novelty Co., 47 Warren street, New York, manufacturers of battery fan motors and power motors, carry a full line of Sieb & Starke's Positive door-openers, metal push-buttons, letter-boxes, etc., etc.

The Edison Electric Illuminating Co., of New York, reports gross earnings for March of $130,407, an increase of $17,801 as compared with the same month of last year, and net $65,257, an increase of $5,061. For the three months ending March 31 the gross earnings were $440,948, an increase of $69,100 as compared with the corresponding period of last year, and net $233,870, an increase of $23,-844.

N. M. Garland, general agent for the Meston Motor Co. and the Storey Motor and Tool Co., has removed from 120 Liberty street to 112 Liberty street. He reports having taken some large contracts for Storey motors. These machines are especially adapted to direct machine driving. They are made for buffing, polishing and grinding lathes. Mr. Garland has on exhibition a new alternating current ceiling fan-motor, which is in every respect equal to machines of the direct-current type.

Mr. Maxwell M. Mayer, 415 East 107th street, New York city, whose new dynamo we recently described and illustrated, is finding a very gratifying demand for his machine. He recently equipped his factory with the latest improved machinery and special tools for the manufacture of the new dynamos. There is already a large call for these machines for light, power, plating and electro-metallurgical work. Mr. Mayer makes a specialty of plating machines, having had years of experience in this particular field.

Sieb & Starke, manufacturing electricians, 411 and 413 East 107th street, are doing a large trade in their Positive electric door-openers. The demand for these devices continues lively. Besides the manufacture of these electric door-openers, Sieb & Starke are giving a great deal of attention to the manufacture of battery motors, of which they are now making a large line. Their goods are celebrated for the quality of material used in their construction and practical utility. At their factory they have a fine display of this class of motors, metal letter-boxes, metal push-buttons and general household electrical goods.

Noll & Sibley, who opened offices in the Postal building, New York, about a year ago, are practical electricians, and familiar with every detail of the incandescent lighting business. Both gentlemen had been for years associated with the most prominent concerns in this line of work, and thus acquired a practical knowledge of the details that is of the most valuable kind. This firm, as announced in last issue, has just completed arrangements to act as sales agents for the Edison incandescent lamp and General Electric Company's supplies of all kinds in New York City. The two members of the firm are known for their energy, and they are bound to reach the top.

W. T. H.

Trade Notes.

The Universal Telephone Co., Indianapolis, Ind., has just issued a handsome little pamphlet on its well-known telephone outfits and apparatus. This company manufactures telephones for exchanges, factories, offices, hotels, residences, etc., and is prepared to co-operate in promoting exchanges. The company desires agents in every county in the U. S.

The Beacon Vacuum Pump and Electrical Co., Boston, has just issued a special-announcement circular of high candle-power lamps, which it sells in barrel lots at "a penny a candle." Hundreds of Beacon lamps that were installed over three years ago are still burning. This company makes lamps from 300 c. p., down to 16 c. p., and offers very liberal inducements to lamp dealers.

WOVEN WIRE BRUSHES.

The Belknap Motor Co., of Portland, Maine, are the patentees and manufacturers of the best woven wire commutator brush on the market.

Electrical and Street Railway Patents.

Issued April 9, 1895.

536,999. Car Fender. George Blakistone, Baltimore, Md. Filed Oct. 29, 1894.

537,004. Electric Metal Heating Process. Geo. D. Burton, Boston, Mass. Filed Dec. 11, 1893.

537,006. Electric Bath Metal-Heating Apparatus. Geo. D. Burton, Boston, Mass. Filed Aug. 24, 1893. Renewed Sept. 10, 1894.

537,007. Method of and Apparatus for Electrically Heating Metal. Geo. D. Burton, Boston, Mass. Filed Jan. 23, 1895.

537,008. Electric Metal-Heating Apparatus. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass., assignors, by mesne assignments, to said Burton. Original application filed Sept. 5, 1892. Divided and this application filed Oct. 11, 1894.

537,009. Method of and Apparatus for Electric Metal Heating. Geo. D. Burton, Boston, and Edwin E. Angell, Somerville, Mass., assignor, by mesne assignments, to said Burton. Filed Aug. 30, 1892.

537,010. Ventilating Apparatus for Dynamo-Electric Machine. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass., assignors, by mesne assignments, to said Burton. Filed Dec. 7, 1892.

537,011. Electric Bath Metal-Heating Apparatus. Geo. D. Burton, Boston, and Edwin E. Angell, Somerville, Mass., assignors, by mesne assignments, to said Burton. Filed Dec. 7, 1892.

537,012. Electrical Welding Apparatus. Geo. D. Burton, Boston, and Edwin E. Angell, Somerville, Mass., assignors, by mesne assignments, to said Burton. Filed March 3, 1893.

537,013. Apparatus for Brazing Metals by Electricity. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass., assignors, by mesne assignments, to said Burton. Filed April 17, 1893.

537,032. Electric Clock. Fred L. Gregory, Chicago, Ill. Filed Jan 30, 1894.

537,058. Incandescent Lamp. Charles A. Merritt, Birmingham, Ala. Filed Sept. 17, 1894.

537,118. Electrical Indicator. Edward H. Johnson, New York, N. Y., assignor to the Interior Conduit and Insulation Company, same place. Filed Oct. 1, 1891.

537,124. Electrical Stearing Gear. Rudolphe Noury, Nouveau Phalère, Greece. Filed March 12, 1894.

537,130. Arc-Rupturing Device. Elmer A. Sperry, Cleveland, Ohio, assignor to James Parmelee, New York, N. Y. Filed Oct. 16, 1894.

537,133. Electric Railway Signal Apparatus. George L. Thomas, Brooklyn, assignor to the Hasell Perfected Railway Signal Company, New York, N. Y. Filed April 23, 1894.

537,161. Police Signaling Apparatus. William H. Kirnan, Bayonne, N. J., assignor to the Gamewell Fire-Alarm Telegraph Company, New York, N. Y. Filed Dec. 28, 1892.

537,171. Car Fender. Elmer D. Abbott, Dayton, Ohio. Filed Jan. 19, 1895.

537,194. Conduit Electric Railway. John H. Guest, Boston, Mass. Filed June 18, 1894.

537,195 Conduit Electric Railway. John H. Guest, Boston. Mass, Filed April 14, 1894.

537,196. Supply System for Electric Railways. John H. Guest, Boston, Mass. Filed June 18, 1894.

537,197. Supply System for Electric Railways. John H. Guest, Boston, Mass. Filed Nov. 3, 1893.

537,198. Electric Railway. John H. Guest, Boston, Mass. Filed Aug. 9, 1894.

537,199. Electric Railway Supply System. John H. Guest, Boston, Mass. Filed Feb. 20, 1894. Renewed Feb. 2, 1895.

537,200. Closed Conduit Electric Railway. John H. Guest, Boston, Mass. Filed April 10, 1894.

537,211. Car Fender. Alfred H. Koeller, New York, N. Y. Filed Sept. 11, 1894.

537,228. Cut-Off, or Safety Attachment for Electrical Conductors. James Parkinson, Maurice Springfield, and Charles Mills, Philadelphia, Pa. Filed Oct. 10, 1894.

537,259. Non-Arcing Switch. Alexander Wurts, Pittsburgh, Pa., assignor to the Westinghouse Electric and Manufacturing Company, same place. Filed April 14, 1893.

537,271. Incandescent Lamp Base. Waldo C. Bryant, Bridgeport, Conn. Filed Dec. 20, 1894.

537,282. Telephony. Ellis F. Frost, Washington, D. C. Filed Dec. 20, 1894.

537,283. Trollery. Zachey T. Furbish and George A. Staples, Augusta, Me., assignors of one third to P. M. Fogler, same place. Filed Sept. 25, 1894.

537,295. Car-Fender. Frederic J. Kranich, Providence, R. I. Filed June 23, 1894.

537,343. Electrical Measuring Instrument. Eugene Hartmann and Wunibald Braun, Bockenheim, Germany. Filed Nov. 27, 1891. Patented in Switzerland July 15, 1891, No. 3,959; in England July 16, 1891, No. 12,117; in Belgium Sept. 10, 1891, No. 72,644, and in Germany July 14, 1892, No. 63,219.

537,358. Electric Battery System. Adoniram J. Powell and William H. Hall, Brooklyn, N. Y. Filed Nov. 13, 1894.

537,402. Electric Bath Metal-Heating Apparatus. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass., assignors by mesne assignments, to said Burton. Original application filed Sept 5, 1892. Divided and this application filed Oct. 11, 1894.

537,404. Apparatus for Electrically Heating Metal. George D. Burton, Boston, Mass. Filed Nov. 6, 1894.

537,405. Apparatus for Electrically Heating Metal. George D. Burton, Boston, Mass. Filed March 16, 1895.

537,406. Car-Fender. Anthony P. Cadden, Baltimore, Md., assignor of one-half to Francis J. Hayden, same place. Filed Jan. 3, 1895.

537,412. Rheostat. John C. Fyfe, Chicago, Ill., assignor of one-half to James Hays, same place. Filed Jan. 24, 1895.

537,414. Closed-Conduit Electric Railway. John H. Guest, Brooklyn, N. Y. Filed Feb. 17, 1893.

537,415. Supply System for Electric Railways. John H. Guest, Boston, Mass. Filed July 6, 1893.

537,416. Supply System for Electric Railways. John H. Guest, Boston, Mass. Filed Oct. 12, 1894.

ELECTRICAL AGE

Vol. XV., No. 17. NEW YORK, APRIL 27, 1895. Whole No. 415

Established 1883.

Entered at New York P. O. as second-class matter, January 18, 1891.

THE ELECTRICAL AGE PUBLISHING CO., Publisher

TERMS OF SUBSCRIPTION:

One Copy, one year,	$3.00
One Copy, six months,	1.50
Great Britain and other Countries,	4.00

Cable Address (all Cables,) "Electage," New York.

W. T. HUNT, President. F. N. BASSETT, Vice-President.

T. R. TALTAVALL, Secretary and Editor.

NEWTON HARRISON, E. E., Scientific Editor.

Canadian Representative, E. W. SAYER, Montreal, Que.

ADDRESS ALL COMMUNICATIONS TO

THE ELECTRICAL AGE PUBLISHING COMPANY,

First Floor, World Building.

NEW YORK.

NEW YORK, APRIL 27, 1895.

CONTENTS.

MR. GEORGE A. HAMILTON.

The American Institute of Electrical Engineers, in selecting Mr. George A. Hamilton to fill the unexpired time of the late treasurer, George M. Phelps, paid a fitting tribute to the sterling worth of one of its most gifted members. Mr. Hamilton's character is irreproachable. He is one of the hardest and most faithful workers of the Institute. He has its interest at heart and none is better qualified than he to fill the position. We extend our congratulations to Mr. Hamilton.

BEEF AND LEATHER BELTING

How many of our readers realize the portentous fact that there is an intimate relationship between beef and leather belting? The same cause that recently brought about an increase in the price of beef, is having the same effect on leather belting. A scarcity of cattle means a scarcity of porterhouse steaks and hides, and a decrease in the supply of hides means less leather with which to make leather belting. An increase in the price of leather belting is impending.

NO ALLIANCE.

It seems now that the reported arrangement between the General Electric Company and the Westinghouse Electric and Manufacturing Company never had an existence. The New York *Sun* claims that all of the reports current last month concerning the matter were for no other purpose than the manipulation of the stock market, and that it became apparent at the outset, to those who were in position to act, that any arrangement between the two interests of the nature proposed was impossible. Yet in face of that certain parties on the inside, presumably for private gain, kept the market misinformed as to the true situation. Later events seem to confirm the belief that no negotiations were ever entered into by the two companies. The Westinghouse Company is now suing its big rival for infringement of patents; so, after all, the supposed advantages of the reported consolidation will not be realized.

A STEP BACKWARD.

Professor Anthony, in his paper read before the American Institute of Electrical Engineers last week, expresses surprise at the action of the New York Board of Fire Underwriters on March 20, last. The board "resolved" to approve a certain make of insulated wire for electric installations. The wire referred to is insulated with a standard insulation, having woven upon it two additional coverings of extra heavy braid. This brand is presumed, from the action of the underwriters, to be classed by them on a par with the conduit system of wiring. Such classification, Professor Anthony thinks, is wrong. The foundation principle of all rules for the placing of conductors, he argues, should be accessibility. An insulated wire of the class referred to certainly does not fulfil this requirement, and why the Board of Fire Underwriters should confine the operation of their resolution to this one brand when there are other good highly insulated wires that would fulfil the same conditions, he does not understand. He looks upon the board's action as one of those inexplicable diversions that always attend progressive development in every field, but which soon become extinct. The gist of Professor Anthony's argument is this: After years of costly experimentation and practical development it has become a settled principle that in order to secure safe concealed wiring it is necessary to provide a mechanically strong and electrically insulating tube or raceway into which and from which the conductors can be inserted and withdrawn at pleasure, and at one stroke the New York Board of Fire Underwriters virtually repudiates this practice, and reverts to first and crude principles and obsolete practice.

CUTTING AND SINGEING HAIR BY ELECTRICITY.

One of the latest uses to which electricity has been applied, and one which will undoubtedly come into popular favor, is the process of cutting and singeing hair by the electric current.

The operation is known as "Cinge Cutting," and it is not only beneficial to the hair, but a pleasure to the one being operated on.

The apparatus is shown in fig. 1. It consists of a comb, over the teeth of which is stretched a platinum wire. When the thumb push-button on the comb is pressed the current passes through the wire and raises its temperature to white heat.

The comb is then passed through the hair, and the process of "cinge cutting" is begun. As the hair comes in contact with the hot wire it is cut, and at the same time the ends are singed. By this process the unpleasant pulling and pinching, so common with the use of shears and clippers, is entirely eliminated.

It is not intended here to explain the benefits of singeing the hair, for it is too well known to all that the hair is hollow, and that this hollow is filled with an oily substance, which gives life, beauty, and vigor to the hair. When cut with shears the hair "bleeds," so to speak, and this oil is lost till nature again closes the little hair tubes.

This arrangement prevents a burn by accidentally dropping the comb.

One of the most notable features of this process is the evenness of the cutting, for the reason that the platinum cutter is always in a straight line and in one position. Therefore, it cannot cut the hair unevenly, and since the hot wire is not a live flame, it is impossible to set the hair on fire, as is so often the case when using a torch, gas flame, or taper, as in the old process.

The rapidity of the work is also a welcome improvement found in the electric "cinge cutting."

To use the apparatus all that is necessary is to remove an incandescent lamp from the socket, put the plug of the "cinge-cutting" comb in its place, and it is ready for business.

The whole apparatus is very simple, and its liability to get out of order is reduced to a minimum. Repairs are easily and quickly made, and any barber or hair-dresser can use the apparatus without trouble. Platinum cutters are taken out or new ones put in in three seconds, and without the aid or use of tools of any kind. In fact the whole of the apparatus can be so taken apart.

Fig. 2 shows the practical application of the process of "cinge cutting."

The Bell Electric Company, 26 Church street and 28 Cortlandt street, New York, are the manufacturers and patentees of the apparatus.

This apparatus was exhibited before the Society of Electricians at the Edison building, on Pearl street, Brooklyn, at their meeting Tuesday evening, April 23, and was pronounced an unqualified success.

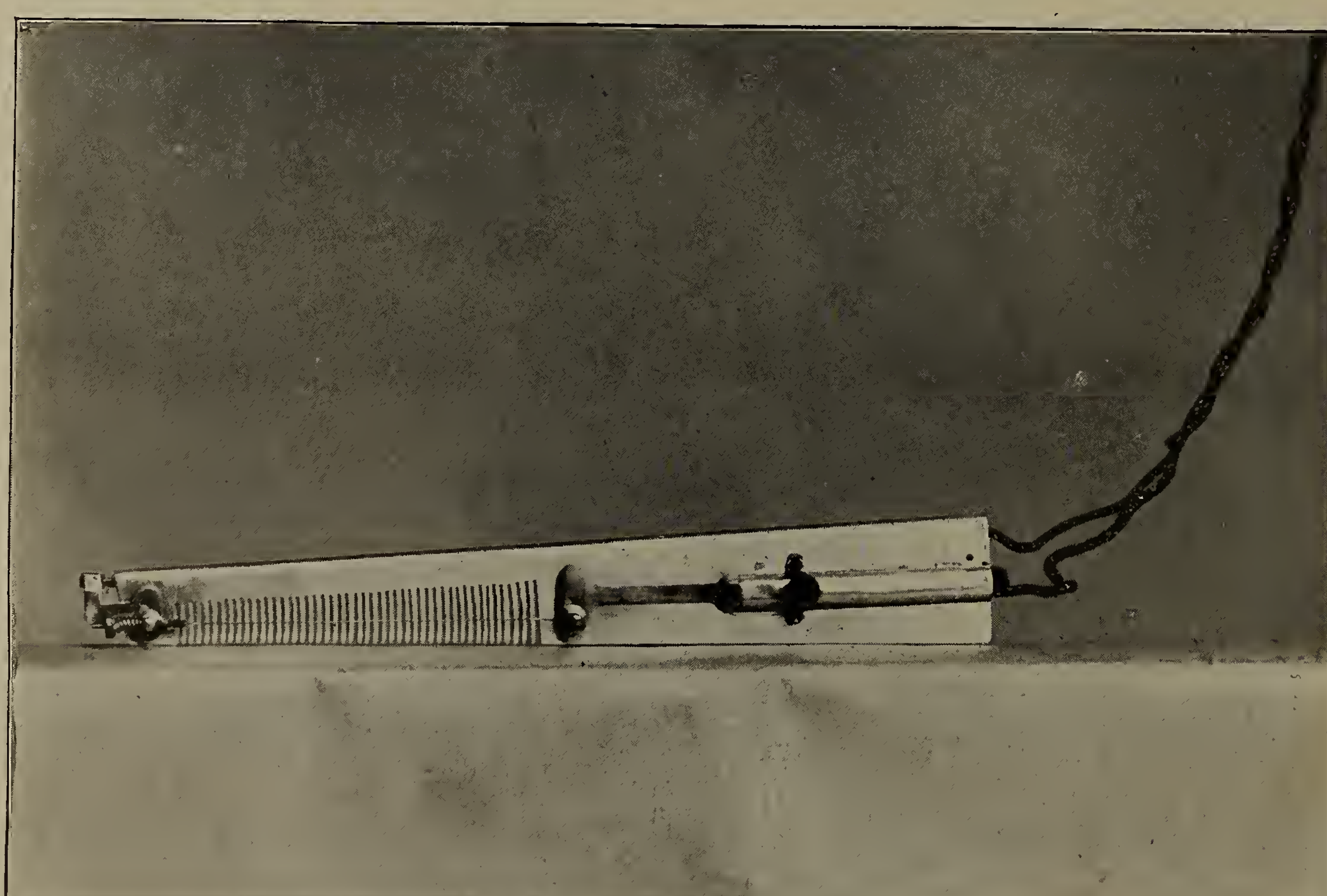


FIG. 1.—"CINGE CUTTING" APPARATUS.

By the electric "cinge cutting" the end of each hair is cauterized when cut, by coming into contact with the hot wire. This, of course, closes the ends, and prevents the loss of the oil. It is also claimed that this process prevents catching cold in the head after a hair cut.

The construction of the "cinge-cutting" comb is such that there is absolutely no danger of a shock, and as the teeth of the comb are always between the hot wire and the head, there is no danger of a burn. The thumb must be pressed down firmly to admit the current to the cutting wire, and the moment the thumb pressure is released, the connection is broken, and the wire becomes instantly cold.

MR. EDISON BIDS $125,000.

It is reported that Mr. Thos. A. Edison has bid $125,000 for the remaining assets of the North American Phonograph Company. The company failed last August with assets estimated at $150,000 and liabilities of $450,000. The assets consisted mainly of patents. Mr. Edison foreclosed a lien on the company before it passed into the hands of Receiver John R. Hardin. Mr. Edison's bid of $125,000 has been submitted to Chancellor McGill, and is likely to cause a legal fight between Mr. Edison and the other stockholders of the defunct company.

THE WESTINGHOUSE AND GENERAL ELECTRIC.

The New York *Sun*, of April 17, publishes what purports to be the inside history of the recently reported deal between the General Electric Company and the Westinghouse Company. According to the *Sun*, the whole thing was a deliberate scheme to mislead the speculative community and work the stock market. The starting-point of the matter, however, had some foundation, although it was uncertain ground to build such great hopes on. According to the story the suggestion was actually made to the Board of Directors of each of the two companies that an agreement between the two interests might be negotiated that would reduce competition and result in the establishment of uniform and better prices for their respective products. This suggestion, it is stated, was the outcome of an informal conference between H. McKay Twombly, of the General Electric Co., and Mr. George Westinghouse, of the Westinghouse Company. Acting upon the suggestion, a special committee was appointed by the directors of each company to investigate and report upon the advisability of an arrangement of the character proposed. The committee representing the General Electric Company consisted of President C. A. Coffin, C. H. Coster and T. Jefferson Coolidge, jr., and that of the Westinghouse Company was composed of George Westinghouse, Marcellus Hartley and Charles Francis Adams. The General Electric subcommittee held one meeting at which it was decided that "the basis of the proposed alliance was upon fundamental lines that precluded the opening of negotiations with the sub-committee appointed by its competitor." The two committees never held a joint session.

The General Electric directors at their regular monthly meeting on April 16 received the report of its sub-committee and the committee was discharged from further consideration of the subject. This, the *Sun* says, is a brief inside history of the matter.

The facts in the case, as the public understood them, were quite different, and the *Sun* gives a history of the manipulation of the General Electric stock during March and up to the present time. It asserts that a news agency was used as the medium for disseminating the manufactured news about the impending alliance, and persistently kept it up with apparent show of authority. It states that so far as can be traced only one person—a director of the Westinghouse Company—is responsible for the "false stock-jobbing reports.'

So much for the *Sun* version of the matter.

The Westinghouse Company now publishes a notice to the effect "that induction motors operated by the so-called Monocyclic system offered for sale by the General Electric Company are in fact multiphase motors and are broadly covered by the patents of Nikola Tesla owned by the Westinghouse Electric and Manufacturing Company."

The motors and system of distribution advertised by the Stanley Electric Company, of Pittsfield, Mass., the Westinghouse Company alleges, are also an infringement of the Tesla patents. The Westinghouse Company announces that suits have been brought against each of the last-named companies, and are being pressed to a hearing as rapidly as possible.

FIG. 2—PRACTICAL APPLICATION OF THE PROCESS OF "CINGE CUTTING."

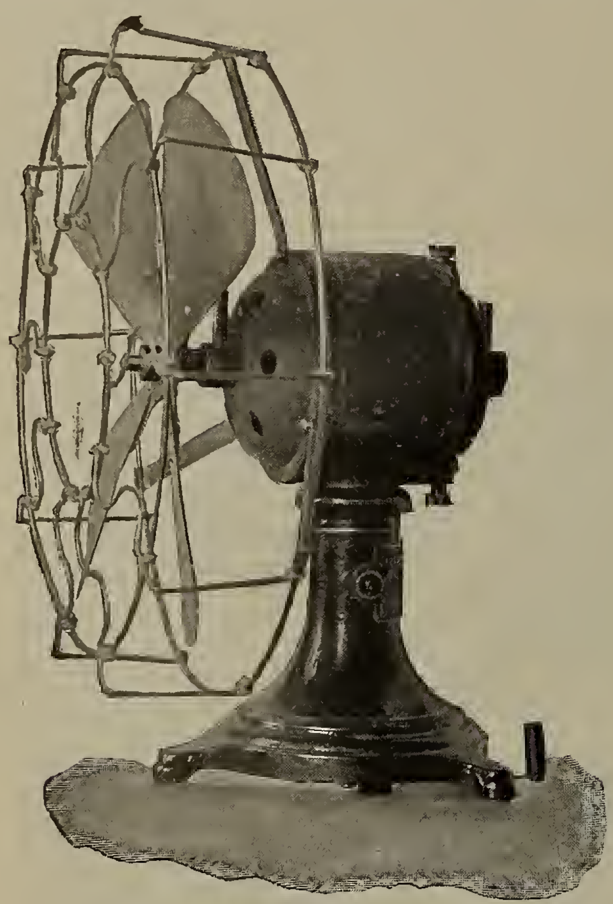
This action on the part of the Westinghouse Company, in conjunction with the *Sun's* story, leads to the belief that the two companies are separated by as large a breach as ever. A great deal of mystery has enshrouded the reported alliance between the two companies, but it now seems that the mystery was a necessary element in the plans of those who were manipulating the market, while the announced intention of the Westinghouse Company to make it warm for the General Electric Company for infringement of the Tesla patents apparently confirms the claims that the two companies have not come to an agreement on any point.

SIGNAL CORPS HAVE FUN.

On the evening of April 15 the Ninth Regiment Signal Corps, Company E, N. G. N. Y., gave an entertainment and reception at its Armory, on West 26th street, New York. This signal corps is composed entirely of practical telegraphers. Mr. George H. Goodfellow, formerly connected with the ELECTRICAL AGE, is electrician-in-chief and secretary of the corps.

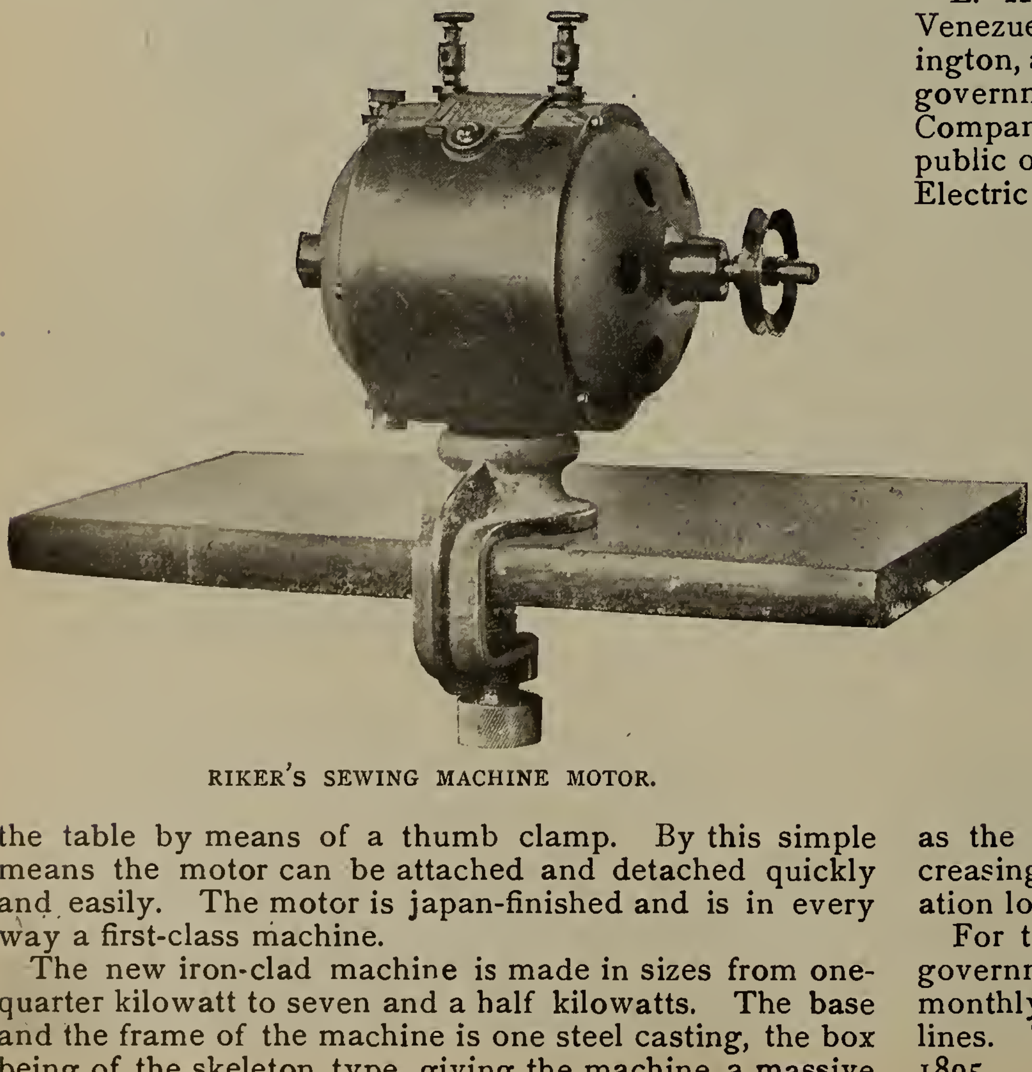
NEW RIKER MACHINES.

The Riker direct-current fan motor for 1895 is a great improvement over the 1894 machine. It has a 12-inch, four-bladed fan and is arranged with a switch for four speeds. It runs from 900 to 1800 revolutions per minute and is designed for a 120-volt current. At 1800 revolutions it takes only one-fourth ampere of current, making it one of the most efficient motors on the market.



RIKER FAN MOTOR.

The Riker sewing-machine motor is applicable to the table of the machine, as shown in the illustration. A regulator is controlled by the treadle, and by operating the latter any desired speed of the machine can be had. This motor is designed for either direct-current electric light circuits or batteries. It is small in size and is attached to

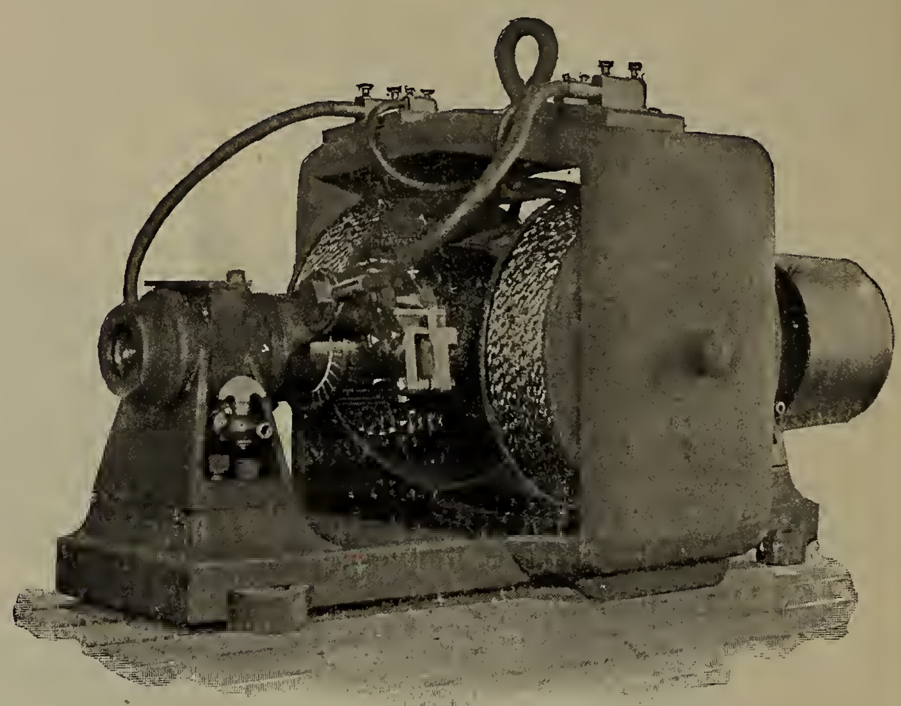


RIKER'S SEWING MACHINE MOTOR.

the table by means of a thumb clamp. By this simple means the motor can be attached and detached quickly and easily. The motor is japan-finished and is in every way a first-class machine.

The new iron-clad machine is made in sizes from one-quarter kilowatt to seven and a half kilowatts. The base and the frame of the machine is one steel casting, the box being of the skeleton type, giving the machine a massive and solid appearance, although it is really light in weight. The fields are circular in shape and have horned pole-pieces. These are of cast steel and bolted firmly to the yokes. The armature is of the toothed-drum type. The dynamos of this type are compound wound, while the motors are shunt wound, the winding being so proportioned that the machine will regulate within two per cent.

These machines are fitted with Riker's parallel brush holder. The holder is fastened rigidly on the frame, the brush being clamped by a flexible spring tension. The feeding of the brush is accomplished by the same spring tension. This brush holder is the most unique and simplest in the market and was patented May 22, 1894.



RIKER IRON-CLAD DYNAMO.

All of these machines are made by the Riker Electric Motor Company, Nos. 45 and 47 York street, Brooklyn, N. Y.

THE TELEPHONE IN VENEZUELA.

E. H. Plumacher, United States Consul at Maracaibo, Venezuela, has transmitted to the State Department, Washington, a translation of the contract between the Venezuelan government and the American Electric and Manufacturing Company for the establishment of telephone service in the public offices. Consul Plumacher states that the American Electric and Manufacturing Co., which was formerly known as the American Telephone Company, is constantly increasing its business in Venezuela, having already in operation long-distance telephones between remote points.

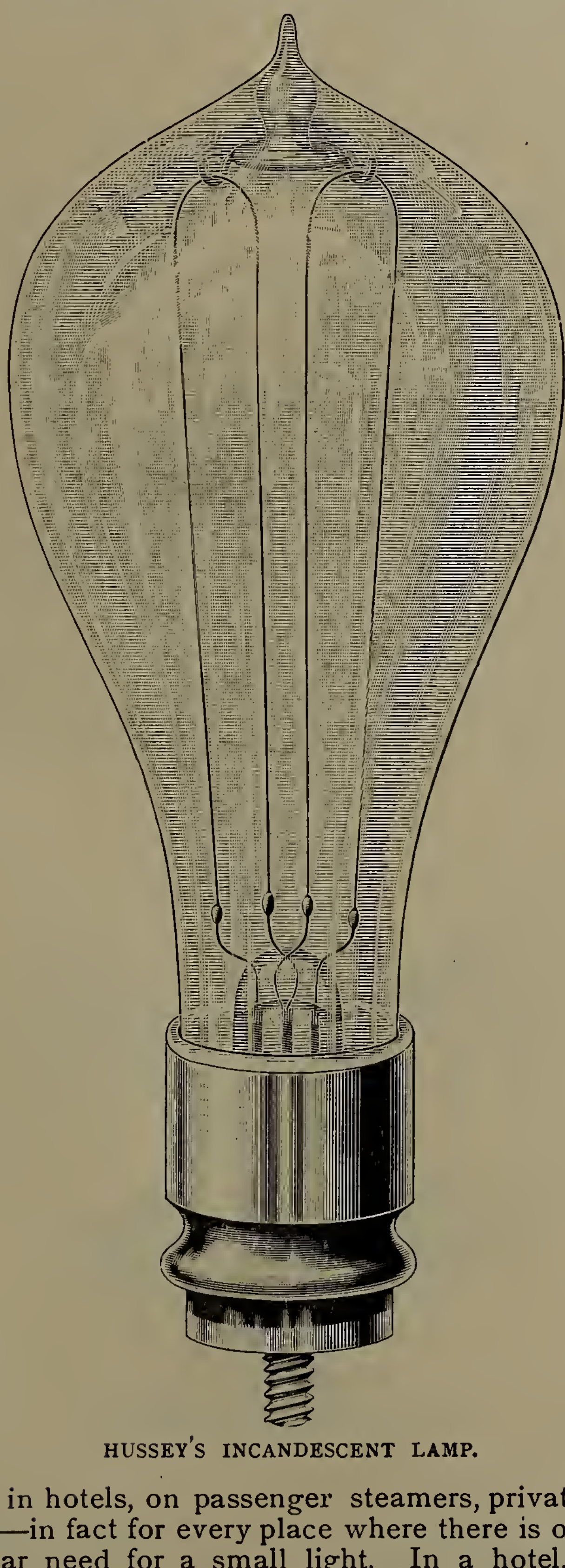
RIKER PARALLEL BRUSH HOLDER.

For the public service referred to (25 instruments) the government pays the company 494 bolivars ($95.33) monthly, including the connections with the long distance lines. The contract runs for one year from January 1, 1895.

VARIABLE INCANDESCENT LIGHT.

Notwithstanding the perfection to which incandescent electric lighting has attained, there is one feature in connection therewith that seems to have baffled the ingenuity of inventors; we refer to the practicability of turning down the light. Up to the present time devices of this character have been uneconomical for the reason that there was considerable waste of energy; what is wanted is a device that will give a small light with a corresponding consumption of energy—that is, one that will take just sufficient current to give the required light, with no unnecessary waste.

There is great need for a lamp of this description, particularly in hotels, on passenger steamers, private houses, factories—in fact for every place where there is occasional or regular need for a small light. In a hotel, or on a steamer, for instance, many guests and passengers are in the habit, where gas is used, to turn the light down on retiring. With the electric light, however, this is not possible, because it affords no intermediate illumination—it is either total darkness or full light, and an electric lamp that could be turned down low, giving just enough light to see by, has been a crying necessity for years.



HUSSEY'S INCANDESCENT LAMP.

The problem seems to have been successfully solved, however, by Mr. C. A. Hussey, of New York, the well-known inventor.

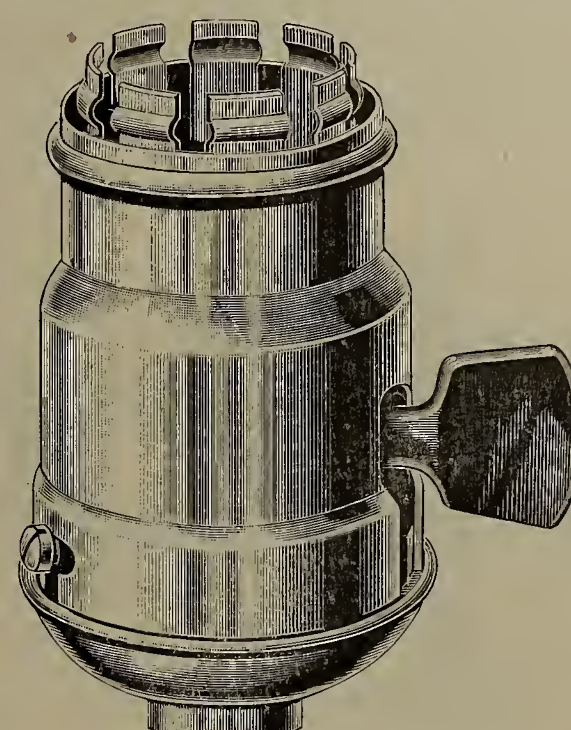
Mr. Hussey employs for the purpose a lamp with two filaments and a socket of new design. The inner terminals of the two filaments form a common junction in the base, while the outer terminals are independent, thus each lamp has three terminals. The socket has three contact points, so that by turning the key to the first stop a small light is obtained by throwing the two filaments in series; by turning the key to the second point one filament is thrown in, giving a light of one-half of the full candle-power, and the third point throws the two filaments in circuit in multiple, giving the full candle-power. The fourth point opens the circuit.

It is obvious that by using two 110-volt filaments in a lamp, a practical and reliable 220-volt lamp is obtained by throwing the two filaments in series, as above.

Such a lamp of this candle-power has long been a much-desired article, and Mr. Hussey's invention seems to solve this problem very completely.

In this new lamp there are no rheostats or resistance, and no generation of heat, consequently there is no needless consumption of current. The latter is simply turned through one filament or both, according to the amount of light reqnired.

These lamps can be made of any candle-power, and their use effects a great saving in current and copper by avoiding the necessity of a third wire. They also avoid the use of converters.



HUSSEY'S REGULATING SOCKET.

The socket is remarkably simple in construction, and in appearance is precisely like those of the ordinary make. Any single filament lamp can be used on this socket as well, without any other alteration than the simple turning of a small screw to stop the key on the second turn. The utility of this socket is therefore very great. It answers for the old style and the new style of lamps equally well, and gives the advantage, when used in connection with the two-filament lamp, of enabling the light to be turned down. The new sockets cost practically no more to manufacture than the old.

The manufacture of these lamps and sockets offers a rare opportunity for the investment of capital. Mr. Hussey has not yet begun to make them, but will do so as soon as satisfactory arrangements can be completed. He has already one order for 10,000 sockets and orders keep coming in. As soon as arrangements can be made these lamps and sockets will be produced on a large scale. We understand that the English and Canadian patents are for sale.

Parties desiring further particulars regarding these new articles may address Mr. C. A. Hussey, care of the Electrical Age.

Mortgage Foreclosure.—The entire plant and franchise of the Marietta Electric Light Co., Marietta, Ga., will be sold on May 7 under foreclosure of mortgage. Mr. M. G. Whitlock is general manager of the company.

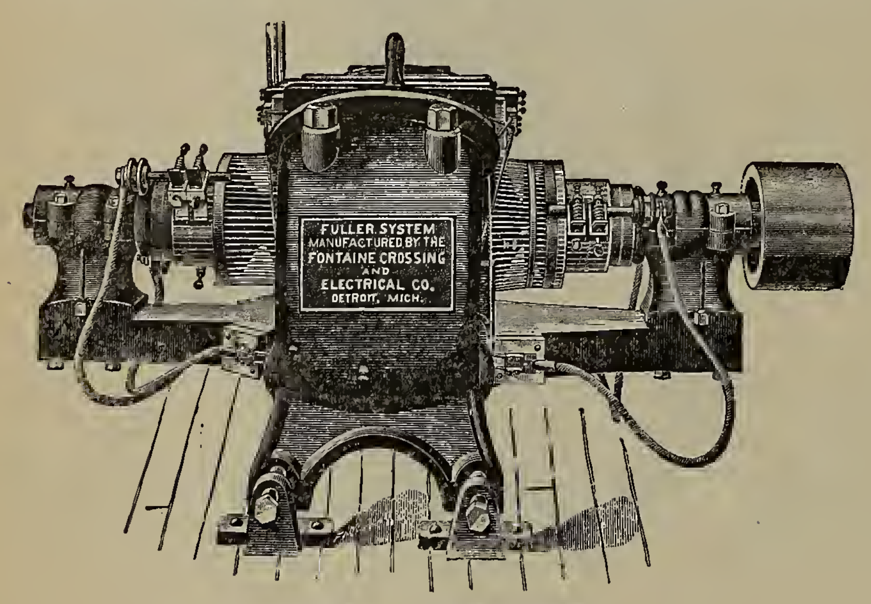
DOUBLE VOLTAGE DYNAMO.

In electric stations in cities the question of floor space is one of the most important factors in the design of the plant. Floor space is valuable in large communities, and it is obvious that if one machine can be built to do the work of two, a saving of 50 per cent. in space is at once effected by this means alone.

The production of the upright boiler and the vertical engine was brought about by the necessity of economizing in ground space. Dynamos are constructed with as small base area as possible with this object in view, and we find the same purpose underlying the design of manufacturing plants of every character.

The Fuller double voltage dynamo, illustrated herewith, is practically two machines in one. The armature is wound with two independent sets of coils, each set generating an electromotive force of 110 volts. It is obvious that various combinations of 110 and 220 volt currents may be obtained in this machine as in the three-wire system.

The Fuller double voltage dynamo is a constant potential machine, and automatic in its regulation. It has the superior advantage in being applicable to any three-wire system without the necessity of having to alter the wiring of a building. It can be used as well also on the two-wire system for either the 110 or 220 voltage. This machine can be used in operating motors at 220 volts and lighting at 110 volts, this dual advantage making the Fuller dynamo one of the most serviceable machines available.



DOUBLE VOLTAGE DYNAMO.

In the work of building steamers and locomotives and in the general iron-working industries, where electric cranes and portable drills are used, a machine of this description is valuable, for the reason that a current of electricity can be carried to a great distance for power purposes on economical sized wire, while the remainder of the machine can be used for lighting purposes. This will also apply to business blocks, where electrical elevators, pumps, electric ventilating fans and small machinery are used, as it is a measure of economy to run this class of machinery at the higher voltage.

Current from this machine can be taken in any quantity desirable. For example, in a 100 horse-power generator the current can be taken at 110 volts or at 220, while any intermediate number of horse-power, from zero to full load, can be taken at either voltage, or both at the same time.

In the ordinary system of lighting and power service, where two voltages are desired, it has always been necessary to couple two machines in series, thus making the first cost of the plant extremely high. While the cost of a dynamo of this description is higher than a single-voltage dynamo, it is low when compared with the cost of two machines installed; and the attendant has only one dynamo to look after instead of two.

These machines are guaranteed to regulate within two volts, from zero to full load, with brushes practically at fixed point of commutation.

Particular attention has been given to the mechanical construction of this machine, the bearings being long and large in diameter. The field windings are of high resistance, while the armature windings are of low resistance, insuring long life, from the fact that heating is almost entirely avoided. The bearings are self-oiling and self-aligning, insuring perfect lubrication.

These dynamos are made of the bi-polar and multipolar types, and may be wound for 110, 250, and 500 volts on each side, the combined voltage in each case being of course double the figures given. They are said to be very efficient machines, and, taking their many advantages into consideration, they should meet with very large favor.

J. Jones & Son, 67 Cortlandt street, New York, are handling this machine. This firm anticipates a great demand for these dynamos.

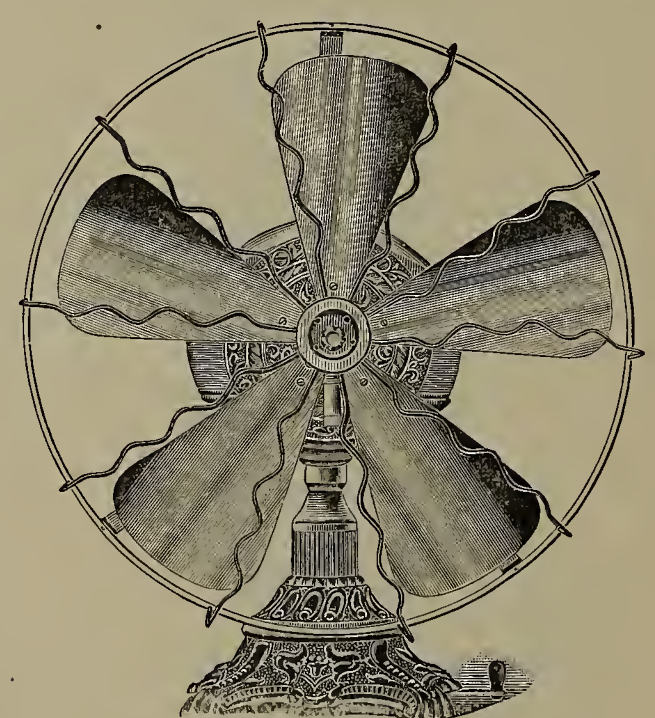
M. & M. FAN MOTOR FOR 1895.

This motor is designed for direct current circuits of 110 volts, and is furnished with 12 or 14 inch fan, as desired. The machine has two speeds, 1,500 and 1,800 revolutions a minute. It is efficient and economical, and noisless in its operation.

A glance at the illustration shows this motor to be a compactly built machine, and of excellent design. It is of one-twelfth horse-power.

Brass enters largely into the make-up of the machine, which metal affords extra opportunity for artistic work. The pedestal is of brass and artistic in design, and this and other brass parts in conjunction with the black japan and gold finish of the other parts, combine to make a very handsome machine.

The Gramme type of armature is used in this motor, the core being laminated. Like parts of these motors are interchangeable, affording easy repairs at the least cost. One supply of oil lubricates the motor all through the season.



M. & M. FAN MOTOR.

The M. & M. Electric Co., 140 Washington street, New York, manufactures these machines.

THE STREET RAILWAY GAZETTE CHANGES HANDS.

The *Street Railway Gazette*, with all its assets, has been purchased by Mr. W. J. Johnston and will hereafter be issued each week from Mr. Johnston's office, 253 Broadway, New York. Mr. Clarence E. Stump, general manager of the paper, and Mr. J. W. Dickerson, the editor, will remain with it. The size of the page will be slightly reduced and the number of pages considerably increased.

UNDERWRITERS' RULES.*

BY WILLIAM A. ANTHONY.

A recent controversy, in relation to inside wiring for incandescent lighting, has suggested to me the importance of bringing out a full and free expression upon the subject from those whose experience gives them the best right to speak, and I venture to bring the matter before the Institute in the hope that it may provoke such an expression as may have some influence in determining the character of any changes in the rules for construction that may be proposed, or in fixing the interpretation to the rules now in force. The present rules are, of course, the result of a process of evolution, and I think every one will admit that the process has been one of progress. In early days of electric lighting, the desire to conceal the wires led to fishing them in between floor and ceiling, and between plastered walls, as had been done with electric bell and burglar-alarm wires. Fires occurred, and were ascribed to the electric wires, sometimes rightfully, but no doubt sometimes wrongfully.

Insurance companies took up the matter, passed rules and appointed inspectors. Many of the rules were good, some were only an annoyance to the construction companies. Different boards adopted different rules, and often the inspector was a law unto himself.

Wishing to assist in securing uniformity, and feeling that electrical engineers, who have to do with the practical work of electrical installation, are best qualified to frame rules for electrical construction, the National Electric Light Association, in 1890, appointed a committee to take the matter in hand, and upon the report of this committee, in 1891, adopted a series of rules, which, with some amendments adopted at later meetings, may be assumed to represent fairly well the consensus of opinions among the electrical fraternity, as to what constitutes a safe electrical installation.

Rules, substantially the same as those, have been adopted by the National Board, and various boards of fire underwriters, and are the recognized rules in force at the present time.

The object of all rules is, first, to secure a safe and permanent installation; second, to provide for the repair or renewal of conductors in case of failure. It may be said that from the standpoint of the insurance companies, the first is the only object, but surely, conductors so installed that they can be easily overhauled and replaced in case leakage is discovered, are safer for the very reason that a fault is likely to be repaired before any serious damage has occurred.

When highly insulated wires, whose insulation resistance was measured in megohms per mile after immersion in water for weeks, came into use for electric lighting plants, it was natural to suppose that they could be put anywhere, and would last indefinitely. They were put in all sorts of inaccessible places; on the beams before floors were laid, in partitions before plastering, on the lath with iron staples, to be covered with mortar. Some such circuits are no doubt in existence to-day, as perfect in insulation as when first put up; but numberless cases of failures of insulation occurred, and experience shows that such a construction is entirely unreliable. Then came the interior conduit, which it was assumed would serve both as a mechanical protection and an insulator, but it was found not to be entirely reliable in either capacity. It was not impervious to moisture, it was subject to damage by nails, saws and chisels. It was found necessary to prescribe that wire of the highest insulation should be used in it, and that it should not be drawn in until all danger from mechanical injury was passed. Then came the brass-armored conduit; but that was not nail proof. Now we have the iron-armored conduit, and it remains to be seen whether this will fulfil all requirements.

It has come to be pretty well recognized that no mode of electrical construction is absolutely proof against failure at some point, and that form of construction is best which affords the smallest chance for injury or depreciation, and offers the greatest facilities for repair or renewal in case of failure.

There has been a uniform progress in the direction of greater safety and better facilities for repair, from the time when wires were put anywhere, to be covered by floors, or mortar, or built into brick walls, to the iron-armored conduit which is offered to-day. To be sure the cost of the installation has advanced, and the iron-armored conduit presents difficulties when alternating currents are employed. To me it seems that the advantages gained are worth the cost, and the difficulty with alternating currents disappears, if the two conductors are placed in one conduit. To this I can see no possible objection when the conduit is iron-armored.

In view of the fact that we cannot be absolutely certain that failures in insulation will not occur in any given installation, it seems to me that the foundation principle of all rules for the placing of conductors should be accessibility. Further, no conductor should be placed where its position or its relation to other conductors in any part of its length is unknown. This means that raceways must be provided, into which conductors may be drawn, and from which they may be removed at pleasure, such raceways to serve as adequate protection from mechanical injury; or the conductors must be placed in mouldings which are themselves accessible, or they must be supported by cleats or insulators in plain sight.

I believe that past experience would warrant the adoption of a rule that would require the use, for concealed work in buildings of fire-proof construction, where conductors must be carried up steel columns, over steel floor beams, in brick partitions, or in plastered walls, of a raceway or conduit, equal in its ability to afford mechanical protection to that known as iron armored conduit, so installed that conductors could be drawn in or out at any time.

And now a word as to the controversy that suggested this paper:

A conductor has been put upon the market, which consists of a standard Habirshaw wire with its covering of rubber and braid, having woven upon it two additional coverings of extra heavy braid. This additional covering, which is tightly woven on, and from which the wire can no more be removed than from its original covering of rubber and braid, the maker, by an extraordinary stretch of language, calls a tube, and claims for it the advantages of the conduit tube prescribed in the insurance rules. It goes without saying that this wire affords no means of replacing a damaged conductor, and, therefore, has not that advantage of the conduit. As to mechanical protection, it certainly is not superior to the unarmored conduit, and it has not the advantage that the conductor can be left out until the danger of injury is passed. As to insulation against moisture, the added coverings do not improve it, the insulation being entirely due to the rubber covering which is inside of all the braids.

And yet I have just learned that the New York Board of Fire Underwriters, on March 20th, passed the following resolution:

Resolved, "That the superintendent be authorized, until further notice, to approve the use of the Attix tube and wire, when equal in quality and insulation to the samples submitted to this Board and tested, under the same conditions where tubing would be permitted; provided that there is no splicing or tapping of the wire, but that its introduction shall be in all cases by the loop system; that in new buildings, when necessary to carry it between floors and plastering, it shall be through holes bored in the beams, not less than two inches apart, a single conductor in each hole, out of the reach of nails; and in old buildings, where necessary to carry it within the reach of nails, it shall be protected by some device from perforation; and provided further that the wire and tube be carried intact into the cut-out boxes, and that in no case shall the outer covering be removed before introducing the core wire into the cut-out box."

It will be noticed that the wire is called a "tube and

* Paper presented at the 96th Meeting of the American Institute of Electrical Engineers, New York and Chicago, April 17, 1895.

wire," when it is no more a tube and wire than the Habirshaw which forms its basis. The tests referred to show that, after immersion in water or being imbedded in plaster, the insulation resistance was 20 megohms per mile. But the Habirshaw wire, without the Attix covering, would have shown the same. What then is the propriety of confining the operation of this resolution to the Attix wire? Why not permit the use of any good highly insulated wire under the same conditions?

It seems to me that this resolution is one of those reversions to an ancestral type which we find in all evolutionary development, which is off the general line of progress, and which is destined soon to become extinct.

BIDS INVITED.

Washington, D. C., April 18, 1895.

Sealed proposals will be received at the office of the superintendent until 2 o'clock p. m., on May 9, 1895, for furnishing the Treasury Department and its annexes with electrical supplies for use during the fiscal year ending June 30, 1896.

The following is a list of the different articles upon which bids may be given:

Adjusters for lamp cord, hard rubber; sample required, each. Batteries, dry; sample required. Batteries, Le Clanche (any form); sample required. Binding posts, brass, machine screw; assorted. Binding posts, brass, wood screw; assorted. Bushings, hard rubber. Buttons, push, bronze; sample required. Buttons, push, nickel; sample required. Buttons, push, pear or similar shape, complete; sample required. Bells, vibrating, 3-inch gong, iron box; sample required. Bells, vibrating, 3-inch gong, skeleton frame; sample required. Cups, porous, for Le Clanche batteries. Cut-outs, fixture, double pole, porcelain. Cut-outs, porcelain, for ceilings. Cut-out plugs, 1 to 30 lights. Cut-outs (branch), D. P., porcelain, 1 to 30 lights. Cut-outs, branch, 1 to 30 lights, D. P. Cut-out wire, assorted, per lb. Chatterton splicing compound, per lb. Dovetailed rosettes, K. W., No. 104, Western Electric Catalogue, or equal thereto. Dovetail rosettes, K. W., No. 106, Western Electric Catalogue, or equal thereto. Handles, wood, for electric lamps. Joints, hard rubber. Key receptacles, polished brass, Edison pattern. Keyless fusible wall receptacles, Electric Engineering Supply Company's Catalogue, or equal thereto. Keyless receptacles, polished brass, Edison pattern. Key, fusible, wall sockets, Electric Engineering Supply Company's Catalogue, or equal thereto. Key sockets, polished brass, Edison pattern. Keyless sockets, polished brass, Edison pattern. Lamp-cord, 2-twisted conductor, No. 12, silk covered, per yard. Lamp-cord, 2-twisted conductor, No. 14, silk covered, per yard. Lamp-cord, 2-twisted conductor, No. 16, silk covered, per yard. Lamp cord, 2-twisted conductor, No. 18, silk covered, per yard. Plugs, attaching, Edison pattern. Push-button plates, complete, nickel, two-button. Porcelain insulator knobs, No. 1929, Western Electric Catalogue, or equal thereto; sample required, per 100. Safety wire-holders, porcelain, No. 1, No. 2566 of Western Electric Catalogue, or equal thereto; sample required, per 100. Safety plugs, Edison, No. 6327 to 6341, per dozen. Shades, tin, flat, green on exterior, white interior, 8-inch, ¾-inch holder, each. Shades, tin, flat, green exterior, white interior, 10-inch, ¾ inch holder. Shades, porcelain, flat, 8 and 10-inch, for 3¼-inch holder, each. Shades, green reflector, ground glass bottom, 9 and 12-inch, each. Shades, silvered reflector, ground glass bottom, 9 and 12-inch, each. Shades, tin, cone, green exterior, white interior, 8 and 10-inch, 2¼ and 3¼ holders, each. Shades, porcelain, cone, green, 8 and 9-inch, for 2¼-inch holder, each. Shade-holders, 2¼, 3¼, 3¾, and 4-inch, per dozen. Staples, safety, insulated, Nos. 10, 15, 20, 25, 30, per 100. Tape, Okonite, white or black, per pound. Tape, Grimshaw, white or black, per pound. Wire, equal to Kerite, Nos. 8, 10, 12, 14, 16, 18, per foot. Wire, gutta-percha, insulated, Nos. 14, 16, 18, and 20, per pound. Wire, office, No. 14, per pound. Wire, two conductors of No. 14, No. 33 copper wire, insulated with silk, for pear-shape buttons, per yard. Zincs, for Le Clanche batteries (any form), sample required; per dozen.

All bids on the above material must be each, except where otherwise specified.

All further information can be obtained from the Chief Clerk, Superintendent's Office, Treasury Department, Washington, D. C.

The Commissioners of the District of Columbia are asking for bids for the following electrical supplies for use in the various branches of the government of the city for the fiscal year ending June 30, 1896. Sealed proposals will be received at the office of the commissioners until two o'clock, p. m., on May 9, 1895.

The following is a list of the articles and amounts of same for which bids are asked:

Sulphate of copper (bluestone)	15,000	pounds.
Sal ammonia, best	400	"
Sheet copper (No. 30 Brown & Sharp's Gauge), cut in strips to order	300	"
Moulded zincs (amalgamated), for Le Clanche battery	10	
Moulded zincs, pure, crowfoot, per sample in office	15,000	"
Glass jars, No. 1, 6 x 8 inches	500	
Le Clanche battery, complete	10	
The Burnley dry battery	500	
Imperial dry battery	500	
Law battery, complete	500	
Holtzer's Cabot Monarch battery, with long zinc	500	
Cold-drawn copper wire, No. 12	10,000	
Galvanized iron wire, No. 12, extra best best quality	1,000	"
Copper wire, okonite insulation, No. 16	2,000	feet.
Copper wire, okonite insulation, No. 12,	500	"
Copper wire, okonite insulation, No. 14,	1000	"
Office wire (copper), No. 16, wound and braided, paraffined and polished	200	pounds.
Office wire (copper), No. 18, wound and braided, paraffined and polished	20	"
Copper wire, two conductor, annunciator, No. 16	1,000	feet.
Copper wire, twin okonite cable, No. 14	400	"
Register paper, cut and wound on spools to order	1,500	pounds.
Register paper, cut and wound loose on spools, chemical	100	"
Double telephone cords, tips, complete, (3 feet long)	500	
Double telephone cords, short (2 feet long)	500	
Glass screws (insulators) Western Union.	2,000	
Brackets, screw, oak painted	1,000	
Double-pointed (telegraph) tacks	10	pounds.
Cross-arms, standard size, best yellow pine, painted, with steel pins, locust-screw tips, complete	5,000	feet.
Screw bolts, with washers, ½ inch x 7 inch	1,000	
Climbers, extra spring steel, with straps (Stubbs)	6	pairs.
Insulator pins, steel, locust-screw tip, per sample	1,000	

THE INVENTOR OF SEAMLESS INSULATION.

Through an error in our issue of last week Mr. Leonard F. Requa, electrician and general manager of the Safety Insulated Wire and Cable Co., New York, was given the credit of being the inventor and patentee of the method of covering cables with seamless lead. While this is an enviable distinction, it is but fair to the real inventor and Mr. Requa as well, to state that it was intended to say that Mr. Requa was the inventor and patentee of the method of covering wires and cables with insulating material without seams.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

The regular monthly meeting of Council was held at 26 Cortlandt street, April 17.

The following associate members were elected :

Baldwin, Jas. C. T., superintendent Chicago Telephone Co., 203 Washington street.

Cabot, Francis Elliott, superintendent of inspection and electrician, Boston Board of Fire Underwriters, 55 Kilby street.

Fortenbaugh, S. B., assistant professor of electrical engineering, University of Wisconsin, Madison, Wis.

Harris, W. C., Jr., electrician, Harris & Williamson, Birmingham, Ala.

Jones, G. H., agent, General Electric Co., Casilla, 18 D, Santiago, Chili.

LeBlanc, Charles, chief engineer, railway department Thomson-Houston Co., 27 Rue de Londres, Paris, France.

Lindsay, Wm. E., chief engineer and electrician, Swift & Co., National Stock Yards, East St. Louis, Ill.

Nunn, Paul N., consulting engineer, San Miguel Consolidated Gold Mining Co., Telluride, Col.

Winslow, George Herbert, electrical engineer, Westinghouse Electric and Mfg. Co., Pittsburgh, Pa.

The following associate members were transferred to full membership :

Schmid, Albert, superintendent, Westinghouse Electric and Mfg. Co., Pittsburgh, Pa.

Dodge, Omenzo G., professor of mathematics, United States Navy, Washington, D. C.

Carus-Wilson, Charles Ashley, professor of electrical engineering, McGill University, Montreal, Can.

Lighthipe, James A., district engineer, General Electric Co., San Francisco, Cal.

Childs, Arthur Edward, electrical engineer, Westinghouse Electric and Mfg. Co., Philadelphia, Pa.

Waring, John, Warner Electric Co., Ovid, N. Y.

Puffer, W. L., assistant professor of electrical engineering, Massachusetts Institute of Technology, Boston, Mass.

Ryan, H. J., professor of electrical engineering, Cornell University, Ithaca, N. Y.

Mr. Geo. A. Hamilton was elected treasurer for the unexpired term of the late treasurer, Mr. Geo. M. Phelps.

At the meeting of the Institute in the evening President Houston officially announced, in behalf of the Institute, the death of Treasurer Phelps, with fitting remarks regarding his services.

Mr. W. J. Hammer, chairman of the special committee appointed by the council, made the following report, which was accepted with a rising vote :

The Council of the American Institute of Electrical Engineers, desiring to express its sense of the loss to the Institute in the death of George May Phelps, at its meeting held Wednesday afternoon, April 17, 1895, at the Institute Headquarters, appointed a special committee of three to draft suitable resolutions, which the undersigned as committee respectfully present herewith.

Resolved : That in the death of George May Phelps, the council has suffered the loss of an energetic, faithful and capable member and the Institute a most efficient officer ; one who was constantly striving to uphold the standard of its work—one who was ever watchful of its welfare. In his disinterested efforts to serve the Institute he brought to bear upon its deliberations his keen perceptions, intellectual ability and eminent force of character.

Resolved : That a copy of this resolution be suitably engrossed and framed, and presented to Mrs. George W. Graham, his daughter, and the sole surviving member of his family.

(Signed)

William J. Hammer.
James Hamblet.
Ralph W. Pope.

A paper by Prof. E. J. Houston and Mr. A. E. Kennelly, upon "Resonance in Alternating Current Lines," was read by Mr. Kennelly and discussed by Mr. C. S. Bradley, Dr. M. I. Pupin and Prof. A. G. Webster.

A paper was also read by Prof. W. A. Anthony on "Underwriters' Rules," which was discussed by Messrs. Hammer, Leonard, Woodbury, Jenks, Holmes, Mailloux, Ayers and Hamblet. A communication from Mr. Fremont Wilson was also read.

On account of the lateness of the hour the final discussion of the paper was laid over until next meeting.

THE LEGAL ASPECTS OF ELECTROLYSIS.*

BY HENRY C. TOWNSEND.

The question arises on this general state of facts,—Upon whom does the responsibility rest for the injuries heretofore accruing, or which may hereafter arise, from the corrosive action of the railway currents? A similar question arose some years ago in controversies between the telephone and electric railway companies. The injury complained of by the telephone companies in these cases was due, not to corrosive action of the railway currents, but to the inductive disturbances upon their pole-lines parallel to the trolley wires, and to the presence upon the telephone lines of the electric railway currents passing to earth and thence to such lines.

In the majority of these controversies the courts refused relief to the telephone companies, and it has been suggested that these cases furnish precedents for the disposition of such controversies as may arise from the corrosive action of the railway currents upon buried metal. Their value as precedents is, however, open to grave doubt.

The contention of the railway companies, as advanced in the prior cases, virtually resolved itself into the claim that they cannot be held liable for the injuries caused to neighboring property through the operation of their road by electricity, because their enjoyment of their rights and franchises is in pursuance of legislative authority. But, as said by the Supreme Court of the United States in a similar case, the grant of powers and privileges to do certain things does not carry with it immunity for private injuries which may result directly from the exercise of those powers and privileges, nor is the liability of a company to respond for damages caused by it affected by its corporate character. Its liability for annoyance, discomfort or damage is the same as that of individuals for a similar wrong.

Nor is its liability affected by the extent or character of its franchise. Whatever the extent of the authority conferred, it is accompanied with the implied qualification that it shall be so exercised as not to work an annoyance or damage to others, and, even if that authority extend expressly to permitting the use of the rail return, the liability for damage caused thereby cannot be escaped, although in some quarters the notion prevails that the railway company cannot be held liable, on the general rule that whatever is authorized by competent authority cannot be treated as a nuisance.

There is, however, a wide distinction between that class of cases in which the act complained of is a public work, done under the authority of the government by persons deriving no personal advantage, but acting within the best of their skill and scope of their authority, and that in which the act complained of as having wrought injurious consequences is done by private individuals, and not essentially for a public purpose, but for private emolument. In the one case the execution of the act is a public duty imposed by the government, and which, having been accepted, must be executed; no claim can lie for consequential damages arising from the execution of that duty. The act of the other is not essentially and only for a public purpose, but mainly for private emolument.

The electric railway company, in respect to individuals or the public, stands in the position of doing an act for its own profit and benefit, the direct and necessary consequence of which is an injury, if the act from which that in-

* Abstract from *Cassier's Magazine* for April, 1895.

jury arises is the use or operation of its system by a return through the rails. The act upon which the legal injury is founded is not the operation of the road by electricity generally, but the employment of the specific kind of plant which the company has elected to build and operate, not because the purposes of its character, so far as the benefit of the public is concerned, could be best carried out by that plan of operation in preference to the system which would work no injury, but because it is primarily for its own pecuniary benefit, though attended by a continuing and grave pecuniary damage to the physical property of others.

It cannot be justly claimed that the beneficial uses of the street, so far as the public is concerned, and in respect to the uses for which the railway company becomes the servant of the public, are in any substantial manner enhanced by the employment of the earth or rail return circuit in preference to that other method which was open to the railway company to employ, though at considerably greater expense, and, of necessity, therefore, at a diminution of profits. Facility and speed of transportation in the city streets is the primary purpose or benefit, in consideration of which railway companies enjoy their franchises to employ the electric current, but no one can safely affirm that this benefit can be accomplished only by the use of that one of the known systems of distributing the electric power which is now generally employed.

The question is, practically, whether the railway company, for its own profit, and not for the benefit of the public interest in the streets, shall be allowed to employ that method of distributing its power, of which the usual and known consequences are to work a serious interruption to the enjoyment of a previously granted franchise, in pursuance of which the streets and the earth have been occupied for the operation of a plant in what was, at the time of its installation, a well-known and recognized way, and was within the corporate powers and grants. There are wrongs, or damage, for which the law provides no remedy, and it is the general rule that if the owner of property, in the prudent and necessary exercise of his own right of dominion, does acts which cause loss to another, it is, as the law puts it, *damnum absque injuria.* So, too, acts of public agents, within the scope of their authority, if they cause damage, cause simply *damnum absque injuria.*

With some exceptions the general rule is said to be that no person is liable for damages incidentally occasioned to others by the necessary and beneficial use of his own property, or of a franchise granted to him by the State, that every man has the right to the natural use and enjoyment of his own property, and if, while lawfully in such use and enjoyment, without negligence or malice on his part, an unavoidable loss occurs to his neighbor, it is *damnum absque injuria.*

On these general propositions a Circuit Court of the United States denies relief to a telephone company, injured by the operation of an electric railway with a ground return, but the decision seems to have rested largely upon the erroneous assumption that the use of the ground return was necessary to the enjoyment of the franchise of electrically propelling cars. Even if, however, the use of the single trolley be lawful, the charge of negligence cannot be escaped if the railway company failed to use the best method of bonding its rails, providing that bonding would remove the damage from corrosion, and any damage that could be shown to have resulted from its failure to use the best means within its power would be recoverable.

While, therefore, the courts may dismiss the claim of a telephone company for damages arising from joint occupancy of the streets, because the injury is the result of a joint attempt of individuals to make use of that to which each alike has a right, and is produced without fault or negligence on the part of the railway company, no such disposition would necessarily follow as to any claim which the owner of an abutting lot might make for damage to his easement in the street for the purposes of water and gas-pipe connection, because, on principle, that use stands practically upon the same footing as his right to secure light and air from the street.

A remedy exists for the injury by corrosion to which buried pipes and cables are at present exposed through the operation of the electric railway companies, and while the difficulty is, from the electrician's standpoint, best met by resort to the double trolley, there is sufficiently reasonable expectation of relief from the expedients which are now being proposed to free the railway companies from the charge of negligence.

THICK FIRES.

It is the prevailing opinion with some that it is necessary when a boiler is worked to a high rate of capacity to maintain corresponding heavy fires. It is argued that thin fires are well enough for slow rates of combustion, but as the call for steam increases it must be met by an increased thickness in the bed of coal on the grate.

As regards a comparison between thick and thin fires, the fact is that more capacity can be obtained from a boiler when a fire of medium thickness is carried and proper attention is given to its condition than can be realized by any system of management when the fires are exceedingly heavy, and advocates of thick fires, who take the ground that they are a necessity when boilers are forced, are entirely mistaken. As to the economy of the two, some persons maintain that heavy fires give the most economical results, but this is questionable. Valuable information on the subject has recently been brought out by the results of two evaporative tests, which we give below. They were made on a 72-inch return tubular boiler having 1,000 3½-inch tubes, 17 feet in length. The heating surface amounted to 1,642 square feet and the grate surface to 36 square feet, the ratio of the two being 45.6 to 1. On the thick-fire test the depth of the coal on the grate varied from 8 to 20 inches, being heaviest at the rear end and lightest at the front end. On the thin-fire test the depth was maintained uniformly at about six inches. The coal was New River semi-bituminous coal. The difference in the results as appears from the figures is an increased evaporation due to thin fires amounting to 15.6 per cent.

Conditions as to thickness of fires.	Thick fires.	Thin fires.
1. Average boiler pressure, pounds	131.6	130.4
2. Average temperature, feed-water, degrees	39.6	43.5
3. Average temperature flue gases, degrees	484	487
4. Average draught suction, inches	0.17	0.18
5. Per cent. moisture steam, per cent	0.25	....
6. Coal, per hour per square feet grate, pounds.	13.72	12
7. Per cent. ashes, clinkers, per cent	5.1	5.7
8. Horse-power developed on basis 30 pounds from 100 at 70, horse-power	140.3	144.4
9. Water evaporation per pound coal, pounds	8.517	9.457
10. Equivalent evaporation, per pound of combustible from and at 212 degrees, pounds.	10.985	12.234

STREET CAR FENDERS.

The Railroad Committee of the New York Assembly, Albany, has reported a substitute for the bills now before that body, compelling the use of fenders on surface street cars. The substitute provides as follows :

Within thirty days after this section takes effect the Common Council of every city in this State may, and the State Railroad Commissioners must, adopt a good and sufficient guard fender or sweep to be used on electric or cable cars, so constructed as to remove, so far as possible, obstructions from the track or prevent injury to persons coming in contact with such cars. Every person or corporation operating a street surface railroad in any city in this State shall, on or before September 1, 1895, cause each of its cars propelled by electricity or cable, to be provided with he guard fender or sweep, if any, adopted by the Common Council of such city, and otherwise, with the guard, fender or sweep adopted by the State Railroad Commission. Every person or corporation using or operating a car after September 1, 1895, which is not equipped with a guard fender, or sweep as required by this section shall be liable to a penalty of $25 a day for each car so used, to be collected by the city and paid into the city treasury, to be applied to the improvement of the streets of said city.

NOVEL WINDOW ADVERTISING SIGN.

All sorts of contrivances are devised for use in show windows to attract the attention of passers-by to the wares for sale, but none is more effective than the apparatus illustrated herewith.

Projecting radially from the central disk are three arms, on the outer end of each of which is supported a square sign-board designed to carry the advertising matter. These square boards are so hung as to maintain a perpendicular position during the entire revolution of the arms.

NOVEL ELECTRICAL ADVERTISING APPARATUS.

The central disk is supported by a rod dropped from the top of the window casing, and behind it is situated the electric motor which supplies the power to revolve the signs. A cell of battery, seen in the illustration, supplies the current for the motor.

The attraction feature of the signs lies in the fact that they are in constant motion. Moving objects attract the attention quicker than stationary objects.

This device is capable of many modifications of this particular application and for advertising purposes it has superior merit.

This unique apparatus is manufactured by Sieb & Starke, 411 and 413 East 107th street, New York city.

A RARE CHANCE TO INVEST.

Chicago is the headquarters of a scheme to build an electric freight railway between New York and Chicago for the transmission of coal and grain. According to a dispatch from that city the capital of the company will be $200,000,000, and its name is the "Inter-Ocean Electric Railway Co." Subscribe for stock before it is all gone. There will be millions in it—when the capital is all paid up.

WHAT IS THOUGHT OF THE "ELECTRICAL AGE."

Excerpts from a few letters taken at random from our files :

—"Worth ten times the subscription price."—R. W. H., Chicago.

—"The best electrical paper I have ever seen or read." —T., Evansville, Ind.

—"Very readable and interesting. My copy goes a regular round each week, and is eagerly read. I hope to get you many more subscribers soon."—S. K. N., Tokio, Japan.

—"You are forging to the top rapidly, and you have my best wishes for success."—W. P. M., Chicago.

—"Your 'Possible Contract' department is invaluable to the electrical contractor. I eagerly scan the column every week, and am pleased to say that it pays me well to follow out the hints you give."—D. H. B., Detroit, Mich.

"I have been very much pleased with your paper, and can highly recommend it."— H. PETERSEN, Milwaukee, Wis.

Telephone Notes.

TELEPHONE PATENTS Issued April 16, 1895.

AUTOMATIC TELEPHONE EXCHANGE SYSTEM.—Ward Decker, Owego, N. Y. (No. 537,603.)

It is proposed to build a telephone line from Athens to Jefferson, Ga.

The Citizens' Telephone Co., Manchester, N. H., will establish a local telephone system in that place. Mr. W. H. Fairchild is interested in the enterprise.

There is some talk of building a telephone line from Bath to Avoca, Cohocton and Dansville, N. Y.

The Missouri and Kansas Telephone Co. will build a new exchange in Marshall, Mo.

The Orange County Telephone Co., Newburgh, N. Y., to connect all places in the county.

The Harrison Telephone Co. has been granted a franchise to establish an exchange in Albia, Iowa, and will commence work in a few days.

Tunkhannock and Meshopen, Pa., are to be connected by telephone by way of Etonville and Mehoopany.

William Strang, S. P. Foster, and others will establish a telephone system in Elmer, N. J.

The Western Telephone Construction Co., of Chicago, has secured the contract to build an exchange in Mt. Vernon, Ohio. It is stated that long distance service will be given by this company throughout that section of the state.

The following named telephone companies have just been organized :

The Bernatz Telephone Co., Helena, Mon.
Gulf States Standard Telephone Co., New Orleans, La.
Southern Standard Telephone Co., Louisville, Ky.
Central Standard Telephone Co., St. Louis, Mo.
American Telephone & Telegraph Co., Richmond, Va.
Middlebrook Telephone Co., Staunton, Va.

Rockland Telephone and Telegraph Company, Albany, N. Y. Capital, $8,000. Directors: William R. Thompson, Frank L. Colgrove, and William Dewey of Nyack; John I. Traphagen of Suffern, G. A. Blauvelt of Monsey, A. A. Demarest of West Nyack, and L. H. Hutton of Nanuet.

The Cartersville Telephone Co., Cartersville, Ga., by John W. Jones, G. G. Leake and John W. Dodds. Capital stock, $5,000.

The Laurens Telephone Co., Laurens, S. C., by E. H. Wikes, J. N. Wright and W. R. Richy. Capital stock, $1,000.

The Citizens' Telephone Co., Chattanooga, Tenn., by F. I. Stone, W. D. Carswell, T. R. Preston and others.

The Clinton Telephone Co., Clinton, Tenn., by Dr. R. K. Madaris, president and general manager, J. C. Strader, vice-president; W. W. Madaris, secretary and treasurer.

The Belton Telephone Co., Belton, Texas, by N. K. Smith, Chas. B. Smith, and J. Z. Miller, Jr. Capital stock, $20,000.

Street Railway Notes.

The North Susquehanna Transit Co. contemplates the building of a line in Danville, Pa.

A franchise has been granted for the extension of the electric road in Brownsville, N. Y.

The Oliver Iron and Steel Co., Pittsburgh, Pa., intends to build an electric railway on Bingham street in that city. The secretary of the company can give further information.

The Central Railway Co., Baltimore, Md., will build a large car-barn of brick, steel and iron. The plans are being prepared by Geo. C. Worthington.

The Consolidated Street Railway Co., Atlanta, Ga., contemplates extending its lines. Joel. Hurt is president.

New York Notes.

OFFICE OF THE ELECTRICAL AGE,
WORLD BUILDING, NEW YORK,
APRIL 22, 1895.

The India Rubber and Gutta-Percha Insulation Co. has given up its office at No. 315 Madison avenue. All communications to the company will hereafter go to 15 Cortlandt street.

The Leather Belting Manufacturers' Association has given notice that the price of leather belting will, on April 22, be increased 20 per cent. This action is primarily due to the advance in price of hides and leather on account of the scarcity of cattle throughout the West.

Mr. Johnson, one of the founders of the Manhattan Electrical Supply Co., 32 Cortlandt street, is ill with typhoid fever, but is now improving.

J. Jones & Son, 67 Cortlandt street, New York, has gotten out for distribution sample books of Empire insulating cloth and paper. These goods are meeting with merited success. They are used in insulating armature, field winding, etc.

A Flushing avenue trolley car, Brooklyn, one morning last week, left the track on a curve and dashed into a saloon. The fender and front dashboard were smashed. As the driver jumped off it cannot be charged that he was after a drink.

The electrical workers on the New York Life Insurance building, at Elm and Leonard streets, went out on strike last week in obedience to the order of the Board of Walking Delegates, in order to support the plumbers, who are on strike. W. T. H.

Possible Contracts.

There is talk of establishing a new electric light plant in Hinckley, N. Y.

An electric railroad is to be built from the pulp mills to the depot, Chateaugay, N. Y.

An electric light plant is to be built in Randolph, Vt.

Hasbrouck Heights, N. J., is agitating the question of electric lights. The clerk of Borough Council can give further information.

A franchise has been granted to the National Water-Works Co., Pittsburgh, Pa., to build an electric light plant in Cleveland, Tenn. W. W. Cunningham, of Chattanooga, has the contract.

It is probable that an electric light plant will be built in Murfreesboro, Tenn., by the city. It is intended to issue bonds for $25,000. The Mayor can give further information.

The Consolidated Electric Light Co., Birmingham, Ala., has placed the contract for its new power plant, which wil, cost $200,000.

Roe Edwards and others, Americus, Ga., will build a telephone line between Americus, Smithfield, Sumter and other places in that vicinity.

Specifications for the Versailles, Ky., municipal electric light plant are now being prepared. W. S. Berry, clerk, can be addressed for further particulars.

L. B. Bradley, of Enterprise, Miss., has obtained a franchise to build an electric light plant in that place.

There is talk of establishing an electric light plant in Barnard, Mo.

There is talk of establishing a municipal electric light plant in Knoxville, Tenn. J. P. Wade can give further information.

Gregory, Shaw & Co., South Framingham, Mass., will install an electric light plant in their factory.

Bellefontaine, Ohio, will issue $15,000 in bonds to establish an electric light plant. For further particulars address the clerk of the city council.

The Manhattan Beach Hotel and Land Co., 11 John street, New York city, will install an electric light system in the Amphi theatre at Manhattan Beach.

A new school building is to be erected in Millvale, Pa., which will be lighted by electricity.

It is proposed to establish an electric light plant in Westerly, R. I. The clerk of the city council can give further information.

D. H. Hostetter, Pittsburgh, Pa., will erect a 15-story building after the plans of J. C. Steen, Pittsburgh, Pa. The building will be lighted by electricity.

New Corporations.

The Greenville Electric Light and Power Co., Greenville, Mo., by E. and Samuel B. Bruckman, and others. Capital stock, $250,000.

The Valdosta Telephone and Electric Co., Valdosta, Ga., by N. A. Williams, J. F. Lewis, and others. Capital stock, $3,000.

The Manhattan Incandescent Light Co., Camden, N. J., by W. Shapleigh, of Camden, and Thomas Dolan. Capital stock, $500,000.

The New York Electric Motor and Ventilator Co., New York City, N. Y., by Sydney Green, of New York; C. A. Sherman and Lincoln Van Cott, of Brooklyn. Capital stock, $30,000.

The Atlantic Highlands, Red Bank and Long Branch Railway Co., Red Bank, N. J., by S. D. Dutcher, David S. Arnott, W. H. Hazard, of Brooklyn, and others. Capital stock, $25,000.

The Denver Electric Traction Co., Denver, Col., by Edward G. Kirk, of Kansas City; Geo. M. Sanders, of Denver, and others. Capital stock, $25,000.

The Texas Electric Co., Austin, Tex., by C. W. Hobson. Capital stock, $5,000.

The Adams-Bagwall Electric Co., Cleveland, O., by P. J. Bagwall, Thos. F. Adams, and F. H. Goff. Capital stock, $150,000.

The Monticello Mutual Telephone Co., Monticello, Ill., by W. H. Plunk, H. N. Knight, and N. W. Hart.

Financial.

The Columbus Street Railway Company has declared a quarterly dividend of one per cent. payable May 4.

The Edison Electric Illuminating Co., of Brooklyn, reports gross earnings for March of $39,394, an increase of $7,706 as compared with the same month of last year, and net $12,290, a decrease of $1,561.

TRADE CATALOGUES.

The 1895 catalogue of the Partrick & Carter Co., 125 S. Second street, Philadelphia, is one of the most complete and artistic we have seen for some time. This house manufactures house goods and general electrical supplies, and is one of the oldest and best known in the trade. The catalogue is excellently illustrated. A list is given of some of the most prominent hotels all over the United States using this company's patent needle annunciators. Every State in the Union and Canada is very liberally represented in the list. Besides the hotels thus mentioned, over 30,000 needle annunciators are used in other hotels, banks, offices, dwellings, and business establishments throughout the United States and Canada. They are also largely used on railway cars, steamboats, yachts, and on several of the United States warships.

The Manhattan Electrical Supply Co., 32 Cortlandt street, New York, has just issued its illustrated catalogue, No. 7. The catalogue embraces electrical supplies of every description, and is well arranged and neatly gotten up.

WOVEN WIRE BRUSHES.

The Belknap Motor Co., of Portland, Maine, are the patentees and manufacturers of the best woven wire commutator brush on the market.

ELECTRICAL and STREET RAILWAY PATENTS

Issued April 16, 1895.

537,474. Secondary Battery. William M. McDougall, East Orange, N. J. Filed January 7, 1893. Renewed June 15, 1894.

537,475. Secondary Battery. William M. McDougall, East Orange, N. J. Filed Aug. 2, 1894.

537,493. Machine for Securing Filament-Holders into Globes of Incandescent Lamps. Arnold J. Spiller and John R. Massey, Cleveland, Ohio, assignors to the Buckeye Electric Company, same place. Filed May 17, 1894.

537,498. Incandescent Electric Lamp. Elihu Thomson, Swampscott, Mass., assignor to the Thomson-Houston Electric Company of Connecticut. Filed May 23, 1892.

537,499. Electric Measuring-Instrument. Elihu Thomson, Swampscott, assignor to the Thomson Houston Electric Company, Boston, Mass. Filed Oct. 26, 1894.

537,500. Electric Measuring Instrument. Elihu Thomson, Swampscott, assignor to the Thomson-Houston Electric Company, Boston, Mass. Filed Oct. 26, 1894.

537,501. Electric Measuring-Instrument. Elihu Thomson, Swampscott, assignor to the Thomson-Houston Electric Company, Boston, Mass. Filed Oct. 26, 1894.

537,515. Electric Switch. James J. Wood, Fort Wayne, Ind. Filed Nov. 12, 1894.

537,538. Electric Switch. Amandus Metzger, Schenectady, N. Y. Filed Oct. 5, 1892.

537,539. Electric Switch. Amandus Metzger, Schenectady, N. Y. Filed April 15, 1893.

537,541. Regulator for Dynamo-Electric Machines. Walter S. Moody, Lynn, assignor to the General Electric Company, Boston, Mass. Filed August 30, 1893.

537,549. System of Electric Distribution. Edwin W. Rice, Jr., Swampscott, assignor to the General Electric Company, Boston, Mass. Filed Feb. 21, 1894.

537,575. Glass Vessel for Secondary Batteries, &c. Hugo Kroeker, Berlin, Germany. Filed Apr. 22, 1893. Patented in England, Dec. 9, 1892, No. 22,639.

537,595. Electrical Interrupter. Gustaf J. Anderson, Brooklyn, assignor to the Ozone Company, same place and New York, N. Y. Filed Feb. 18, 1895.

537,597. Car-Fender. John H. Astruck, New York, N. Y. Filed March 2, 1895.

537,603. Automatic Telephone-Exchange System. Ward Decker, Owego, N. Y. Filed May 14, 1894.

537,610. Car-Fender. Gottlieb Keller, West Hoboken, N. J., assignor of seventeen-twentieths to John Henry Astruck, New York, N. Y. Filed Dec. 13, 1894.

537,617. Electric-Arc Lamp. Charles A. Pfluger, Chicago, Ill., assignor to the Standard Electric Co., same place. Filed July 2, 1884.

537,626. Electric-Railway Conduit System. Harry A. Belden, Washington, D. C. Filed Jan. 26, 1895.

537,630. Electric-Railway Conduit Sytem. Albert N. Connett, Washington, D. C. Filed Jan. 26, 1895.

537,633. Electric-Arc Lamp. Edward H. Crosby, Boston, Mass., assignor of one-half to Otis M. Shaw, same place. Filed Aug. 13, 1894.

537,644. Telegraphy. Robert H. Morris, Roselle, N. J., assignor to the Western Union Telegraph Co., New York, N. Y. Filed August 10, 1894.

537,665. Electric Switch. Henry P. Ball, Bridgeport, Conn., assignor to the Thomson-Houston Electric Company, Boston, Mass. Filed Oct. 19, 1894.

537,672. Electric Railway. Jean Claret and Olivier Wuilleumier, Lyons, France. Filed Sept. 19, 1894. Patented in France Mar. 17, 1894, No. 237,122.

537,673. Electrically-Actuated Vehicle. John B. Clark, St. Paul, Minn. Filed Mar. 3, 1894.

537,693. Process of Evacuating Incandescent Lamps. Arturo Malignani, Udine, Italy. Filed Aug. 15, 1894. Patented in Italy Jan. 7, 1894, XXVIII, 3,550, LXX, 46; in Austria, Mar. 16, 1894, No. 44,486; in Hungary, May 5, 1894, No. 354, and in Belgium July 16, 1894, No. 110,854.

537,696. Electric-Arc Lamp. Louis C. H. Mensing, London, England. Filed Oct. 29, 1894. Patented in England Jan. 1, 1894, No. 67.

537,706. Sectional Conductor for Electric Railways. James F. McLaughlin, Philadelphia, Pa. Filed Feb. 5, 1895.

537,715. Safety-Support for Overhead Electrical Conductors. Alexander D. Pool, Boston, Mass. Filed Aug. 13, 1894.

537,718. Electric-Wire Insulator. Daniel M. Rothenberger, Lancaster, Pa, assignor of two-thirds to Charles A. Inglis and Edward D. Reilly, same place. Filed Jan. 8, 1895.

537,762. Drop-Fender for Street-Railway Cars. Lewis H. Finney, Richmond, Va. Filed Oct. 4, 1894.

537,769. Electric Meter. Haydn T. Harrison, London, England. Filed June 14, 1892. Patented in England Oct. 28, 1891, No. 18,595.

537,809. Car-Fender. Isaac L. Vansant, Philadelphia, Pa. assignor of one-half to Edward H. Johnston, same place. Filed May 3, 1894.

ELECTRICAL AGE

VOL. XV., No. 18. NEW YORK, MAY 4, 1895. WHOLE No. 416

ESTABLISHED 1883.

Entered at New York P. O. as second-class matter, January 18, 1891.

THE ELECTRICAL AGE PUBLISHING CO., PUBLISHER

TERMS OF SUBSCRIPTION:

One Copy, one year,	$3.00
One Copy, six months,	1.50
Great Britain and other Countries,	4.00

Cable Address (all Cables,) "Electage," New York.

W. T. HUNT, President. F. N. BASSETT, Vice-President.

T. R. TALTAVALL, Secretary and Editor.

NEWTON HARRISON, E. E., Scientific Editor.

Canadian Representative, E. W. SAYER, Montreal, Que.

ADDRESS ALL COMMUNICATIONS TO

THE ELECTRICAL AGE PUBLISHING COMPANY,

FIRST FLOOR, WORLD BUILDING.

NEW YORK.

NEW YORK, MAY 4, 1895.

CONTENTS.

THE DEATH OF MR. RICHARDSON.

The announcement last week of the death of Mr. Wm. J. Richardson caused profound sorrow among electrical people. Mr. Richardson was a splendid example of physical manhood, and seemed to be destined to enjoy a long life. He was in the prime of life when death overtook him, and the report of his demise was a painful shock to all who knew him. Mr. Richardson enjoyed the esteem of the electrical fraternity, and while he was quiet and unassuming in his manner he had a host of friends.

THE FIRST MESSAGE.

One of the features of the first meeting of the Telegraphic Historical Society of North America, which was held in Baltimore on May 1, was the placing of a bronze tablet on the site of the old station of the Baltimore & Ohio Railroad, in Baltimore, to mark the place whence was sent the first official telegraph message, on May 24, 1844. Washington was the destination of the despatch. Such a mark will always be of interest to electrical people, and it will be a satisfaction to know definitely and positively just where the interesting event took place.

ELECTRIC ELEVATED ROADS.

Chicago has an electric elevated railroad constructed on approved principles and design. The Intramural road at the World's Fair was the first example made to prove the practicability of applying electric power to such operations, and it met with reasonably successful results. The Metropolitan road in the city itself, while in most respects differing from its prototype, is a result of the World's Fair experience. The New York elevated roads offer an excellent field for the application of electric power, and it is but reasonable to presume that the management of the operating company will watch the result of the Chicago experiment with considerable solicitude and interest. We commend the enterprise of the Chicagoans in this matter.

LOCAL ACTION IN ACCUMULATORS.

The article printed elsewhere in this issue on the subject of local action in accumulators will be found of interest. Mr. G. Darrieus, the author, points out the various sources of local action that occur within a cell, and it is a question of considerable importance as to how these undesirable actions can be minimized or altogether gotten rid of. In all chemical cells, primary or secondary, these influences are met with in varying degrees, and the purity of the constituents of the cell plays a very important part in the result. The suggestions offered by the author could be profitably followed out, and he who can successfully neutralize these negative influences will place the storage cell on a much higher plane than it now occupies —theoretically speaking. The waste in accumulators does not figure much in ordinary calculations, but since they are there and recognizable it would be well to get rid of them as far as possible.

FREIGHT ON ELECTRIC RAILROADS.

The carrying of freight matter on trolley roads is a rapidly growing feature of the electric railway business, which is manifesting itself in various parts of the country. In many places the enterprise of the trolley officials is regarded by steam roads with considerable apprehension, and in certain states railroad companies have made an effort to prevent trolley lines from engaging in any other business than carrying passengers. In Connecticut the trolley lines are making great inroads on the receipts of the principal steam road, and in Pennsylvania they are making themselves aggressive. The Pennsylvania legislature is disposed to favor the cause of the trolley lines. The House of Representatives of that state recently passed a bill permitting electric roads to carry freight matter, and further, repealed all restrictions and limitations contained in charters of electric railroad companies with reference to freight service. The electric railroad business in Pennsylvania is growing to formidable proportions.

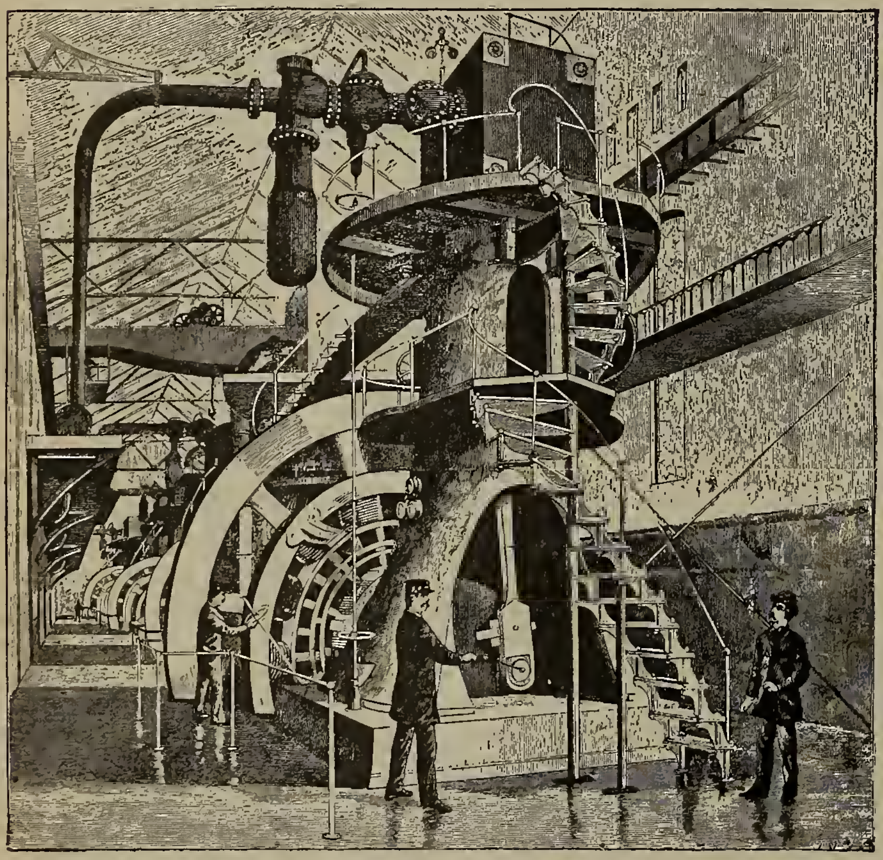
THE METROPOLITAN ELEVATED RAILROAD, CHICAGO.

Profiting by the experience gained in the operation of the Intramural Railroad at the World's Fair, Chicago now has an electric elevated railroad in the heart of the city itself. This road is interesting, since it is really the pioneer of its class, for city everyday service.

The road was formally opened on April 17, and it was intended to have it ready for regular service on May 1.

The line starts from the lake front, in the heart of the business section of the city, and at Paulina St., branches off in various directions. The trunk line and the four branches will have, when completed, an aggregate length of about eighteen miles.

The main line starts on Franklin street. It has four elevated tracks, and is 1.81 miles in length. From Paulina street the Garfield Park and Logan Square branches diverge, and the Humboldt Park line is a branch of the Logan Square line. The Douglas Park line runs south from the Paulina street terminus of the main line westward for a distance of 3.7 miles. Each of the branches has two tracks.



GENERATORS, METROPOLITAN ELEVATED RAILROAD, CHICAGO.

The road runs through the centre of the blocks, thus only crossing streets instead of traversing their length. The company acquired the land by direct purchase, partly through condemnation proceedings, and much of the way was cleared by the destruction of buildings.

The stations are all built under the track, stairways leading to the track platforms.

One car of each train will be the traction car, and will take the current from a special rail laid on the deck of the road. The electric system is that of the General Electric Company.

A view of the generating station of the Metropolitan road is reproduced herewith from the *Scientific American*. The generators, as will be seen, are of the multipolar type, and are driven direct.

One type of generator driven at 75 revolutions per minute maintains a voltage of 500 on no load and 600 loaded, with a current of 2,230 amperes. Another type at 100 revolutions gives 500 volts with no load and 550 volts with full load, and a current of 1,450 amperes. The armature winding consists of heavy bars of copper insulated by mica. They were wound when in place. There are twelve field magnets in the circle inclosing each armature. It was only after the winding of the armature and setting up of the field around it that the engines were assembled. The engines are Allis Corliss, and are compound inverted vertical, direct acting, standing some 50 feet high with 25-foot fly-wheels. There are five; two are of 2,500 horse-power each, the others of 1,000 horse-power each. The dynamo comes between the high and low pressure sides, so as to be inclosed by the engine frames. It is claimed that the energy stored up by the fly-wheel at full speed is enough to run a train of cars from the power house into the city. A Morgan electric crane of 75 tons capacity, also shown in the illustration, spans the engine house, commanding the entire area.

The massive switches are mounted on a white marble base plate. The current from the power house goes to the car motors by the lateral contact rail and returns by the regular rails to the station. Each traction car will carry four motors, so that maximum efficiency will be given at three different speeds. On starting, the motors are thrown into series; at the next speed two are in parallel and two in series, and at the highest speed all are in parallel. Air brakes will be used, a small motor working the air pump on the motor car.

The steam is generated in 16 Babcock & Wilcox boilers, provided with automatic stokers. The plant is so designed as to admit of future enlargement without disturbing existing conditions. It is located on an alley back of Throop street, between Van Buren and Congress streets.

The motor cars were built expressly for this service by the Barney & Smith Car Company, Dayton, Ohio. Each car, without its electrical apparatus, weighs nearly 40,000 pounds; is 40 feet long in body, and 47 feet 3 inches over all. There is a motorman's cab at each end, which takes up a portion of the platform space.

The trains are lighted by electricity,

The Logan Square line is carried over the tracks of the Northwestern Railroad on a bridge with a 250-feet span. Besides this bridge there are other fine examples of engineering skill.

The operation of this road will be watched with deep interest by all concerned. No doubt the question of introducing electric power on the New York Elevated roads will be largely influenced by the results of the Chicago experiment.

ELECTRIC LOCOMOTIVE.

The electric locomotive which has for some time past been in process of construction at the Baldwin Locomotive Works, in Philadelphia, is now completed.

This machine was designed by the well-known New York firm of electrical engineers, Sprague, Duncan & Hutchinson, for the North American Company, which operates the property of the Oregon and Trans-Continental Company in Milwaukee, Wis. It is intended for special experimental work in handling heavy freight and for switching purposes.

An outline description of this engine will be of interest to our readers at this time.

The framing has a heavy steel forging with exceptionally deep pedestals, and is arranged to receive four pairs of boxes fitted with the usual slide-key adjustments. The pedestal boxes are of a special form, made of cast steel, and project inward to form the brackets which carry the motors. The lower sides are arranged to be dropped out, so that the brasses can be readily replaced in the usual manner. These boxes are very massive, and perform the double service of carrying the axles upon which the armatures are rigidly mounted and the field magnets concentric to them. The drivers are fifty-six inches in diameter, the end ones only being flanged. They are close coupled, with only four inches between the faces, and the connecting rods are double-jointed to allow flexibility of movement.

The weight of the armature is directly on the wheels, and not on the journals, while that of the field magnets is on the journals through the pedestal boxes. This system is a unit, the motors all forming part of a single system having a rigid-wheel base of 16 feet, and being coupled together by quarter-cranked connecting rods, instead of

having two or more bogie trucks with independent spring-supported motors.

The motors, four in number and alternating in position, are of the "Continental," iron-clad type, the field magnets being formed of two steel castings, and having two field coils placed at the ends of the motors, with their planes vertical, thus forming two consequent and two salient poles. The magnets are compound wound, the shunt field being light and only sufficient to keep the speed within reasonable limits at light loads and for returning current to the line when running on down grades.

The armatures, which were built by the Westinghouse Electric & Manufacturing Company, are of the slotted type, the slots having curved bottoms and tops and contracted gaps. Each slot carries four wires, but there is only one turn of wire to each bar of the commutator, and the wires are threaded through tubes imbedded in the slots.

The motors are wound for 800 volts at 225 revolutions, this being the equivalent of thirty-five miles an hour when in multiple. They will safely carry 250 amperes of current, giving each motor about 250 horse-power output at 93 per cent. efficiency, and in emergencies can easily stand a great deal more than this. The motors will readily exert a constant drawbar pull of over 10,000 pounds, and have a system of regulation, giving any speed from zero to thirty-five miles an hour under full normal tractive effort. They can start very heavy loads and have ample capacity to slip the wheels. The regulation is of the series parallel system, with resistance thrown into, then cut out of circuit, then again into circuit while changing. The groups are: First, all in series with and without variable resistance, then two in parallel by two in series, then four in parallel with similar use of rheostat.

The four motors are used all the time, there being no position in which one alone is cut out, not even in changing over. These various changes are effected by means of a large contact cylinder on which the three main combinations are made, and a fire-proof rheostat system, with the contact-arm geared in the proper ratio to the main cylinder.

To effect the prompt operation of this controlling system, which can be moved slowly by hand, air pressure from the same tanks that supply the air brakes is employed. This is automatically kept at a constant pressure by a special electric pump.

There is a reversing switch, which is automatically locked in all but the "off" position on the main cylinder, thus preventing reversal under wrong conditions. There are ammeters, voltmeters, a whistle, bell, headlights and the usual accessories. The system of brakes is that known as the "American," and is applied to every wheel. The controlling apparatus is all carried in the cab, which is centrally mounted, has wedged-shaped ends and forward-inclined sections running down to each end of the locomotive.

The total weight of the locomotive is about 134,000 pounds, equally distributed on the drivers.

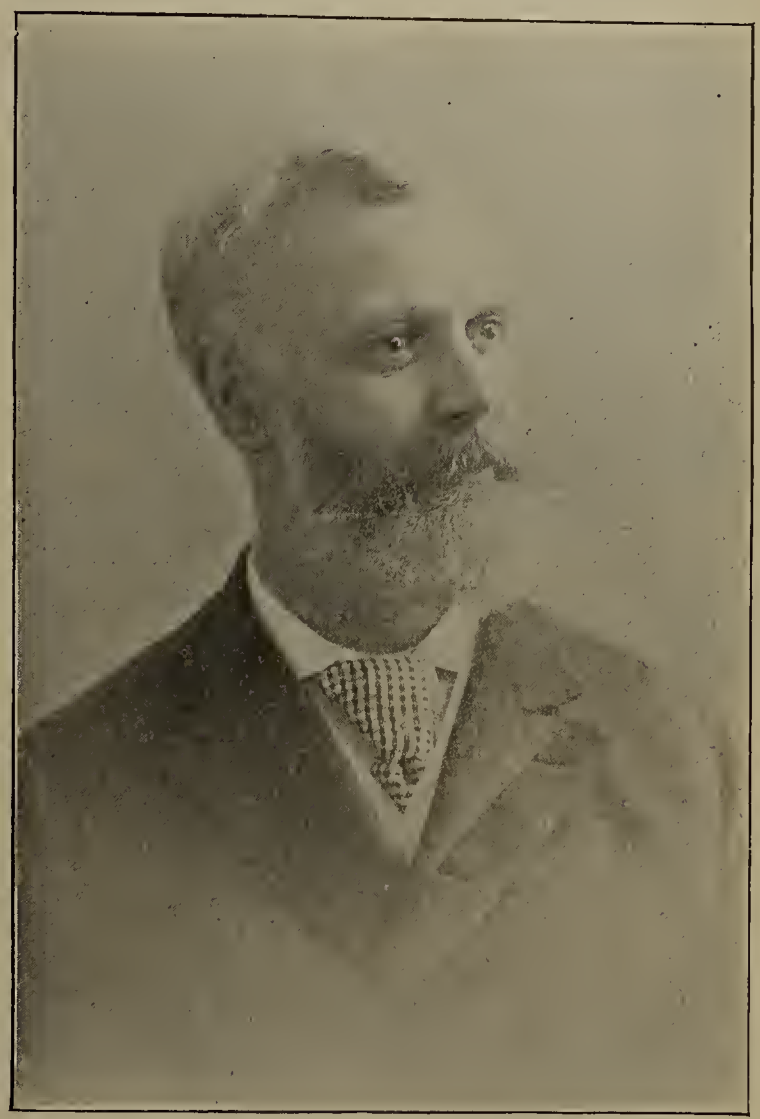
OBITUARY.

WILLIAM JAMES RICHARDSON.

This gentleman, who was so well known in the electrical trades and profession, through his relations with the street railway business, and as secretary of the American Street Railway Association, died at the Presbyterian Hospital, in New York City, on April 26, of spinal meningitis. Mr. Richardson had been under special treatment for the disease for several weeks.

It is stated that the disease was brought about through the mental strain incidental to the recent trolley strike in Brooklyn. He showed decided sympathy with the strikers during the trouble.

Mr. Richardson was born in Albany, N. Y., Oct. 22, 1849. His early education was obtained in the experimental department of the State Normal School at Albany, and afterward he attended Bryant & Stratton's business school, until the election of his father, Mr. William Richardson, in 1864, to the presidency of the Dry Dock, East Broadway and Battery Railroad Company, New York. At that time he came to New York City with his parents, where he finished his business-school education. At the age of sixteen he was engaged in the importing hardware business, in which he remained until 1867, when he accepted a position as assistant to his father in the railroad business in Brooklyn, where Mr. Richardson, Sr., had become largely interested in the lines controlled by the Brooklyn and Jamaica Railway Company. At the end of two years he gave up his business relations with the railroad company to complete his studies, and for this purpose entered the collegiate department of the Brooklyn Polytechnic and Collegiate Institute, where he remained three years. In 1872 he was elected secretary of the Atlantic Avenue Railroad Company, of Brooklyn, which position he held continually until July 1 of this year.



THE LATE WM. J. RICHARDSON.

In 1873 Mr. Richardson married Mary Carrington Raymond, second daughter of John H. Raymond, LL. D., president of Vassar College. Mr. Richardson was an active member of the Hanson Place Baptist Church, Brooklyn.

When the American Street Railway Association was organized, in 1882, Mr. Richardson was elected secretary and treasurer, and continued in this office up to the time of his death, being re-elected annually.

He was president of the Employés Mutual Aid Association of the Atlantic Avenue Railroad, Brooklyn, and during the strike advised the members as to their duty and relations in the circumstances, cautioning them always to forbear violence. He favored arbitration as a means of settling the dispute between the companies and their men. The strike worried him and debilitated him so much that he became an easy prey for disease, and after the collapse of the strike Mr. Richardson had to give up all active business.

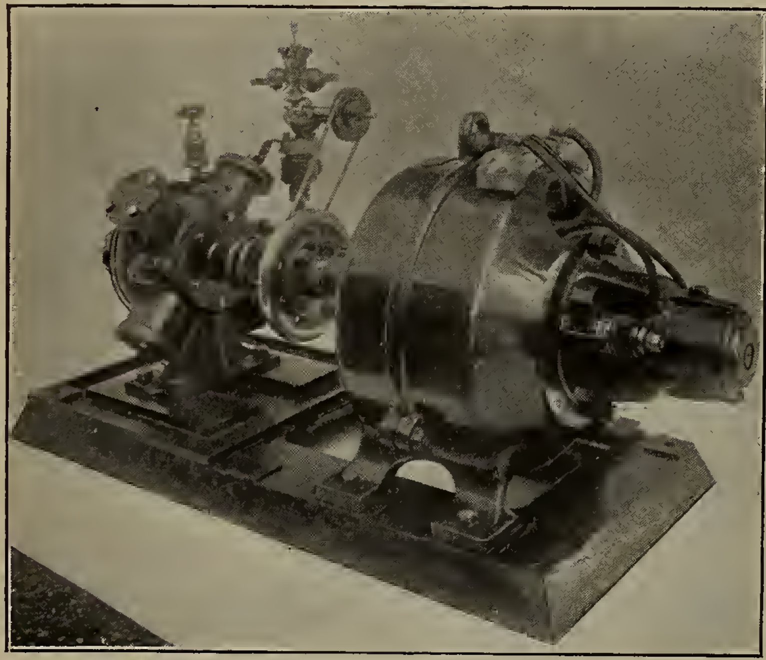
Mr. Richardson was a man of commanding appearance; his character was irreproachable, and his nature kind and gentle. He had scores of warm friends among the electrical fraternity who will be pained to learn of his death.

THE "CROSS" ENGINE.

The Cross Engine Company has moved into more commodious quarters at 126 Liberty street, New York, and will be thus enabled to carry a larger stock of the celebrated "Cross" engines.

The "Cross" engine is an entirely new departure in engine practice. Its chief features of advantage are simplicity in construction, economy of operation, compactness, reliability and low cost. In design it is a radical departure from that of the common engine. It has no dead centre, and may be run at any speed up to 1500 revolutions a minute. All parts are self-lubricating, and the wear is taken up automatically. The working parts are encased, and fully protected from dust and dirt.

There are four cylinders, arranged in pairs, with the centre lines intersecting at right angles. The pistons, which are single acting, bear directly against the crank-



CROSS ENGINE.

pin, and a flexible connection between opposite pistons keeps each in its place on the return stroke.

The valve revolves continuously, being driven directly from the shaft, to which it is loosely keyed. By reversing the valve the engine may be made to run either right or left-handed.

This engine is already in extensive use, and is giving complete satisfaction. It may be coupled direct to dynamos, ventilating fans, blowers, pumps, and all kinds of high-speed machinery.

In the window of the company's new quarters a small "Cross" engine drives a Lundell dynamo, and the small size of the engine compared with that of the dynamo excites general comment.

The Cross engine is a steady runner, and will probably find an extensive use in electrical work.

CANADIAN NOTES.

Mr. C. Bates, Brockville, Ont., has entered into partnership with the firm of T. W. Ness & Co., Montreal, dealers in telephones and electrical supplies. The firm is now registered as Messrs. Ness, McLaren & Bate.

At a meeting of the Montreal Electric Club lately, there was a debate on the merits of the Telegraph versus Telephone Systems for Railway Purposes. The telegraph side of the argument was sustained by W. B Shaw and J. A. Douglas, and on the telephone side were Messrs. E. Daniels, J. A. Shaw and N. Holland. After a spirited and interesting discussion the telegraph system was voted the most suitable.

The Three Rivers Corporation, Three Rivers, Que., is offering its electric light system for sale.

The employés of the Canadian General Electric Company, at Peterboro, Ont., are on a strike. On April 22 the principal foreman of the works, together with the office clerks, draughtsmen, etc., handed in their resignations, in sympathy, it is said, with the striking workmen. The trouble is said to be caused by the general dissatisfaction with the management. There is not a single employé left, and the "lock out" has been in progress about two weeks. Attempts at settlement have failed, and the new men secured by the company are won over to the cause of the strikers and never reach the works. E. W. S.

THE UNIVERSAL TELEPHONE.

This company, which was recently organized in Indianapolis, Ind., has entered the telephone field to compete for business with an instrument claimed to be superior to all others.

The Universal transmitter embodies several novel features, which are said to be very valuable ones. The instrument is easily adjusted (see cross sectional view, fig. 3). It is arranged with a compensating contact which prevents the loss of any of the vibrations of the diaphragm—all being utilized in actuating the receiver. By a device attached to the instrument any tendency to throw

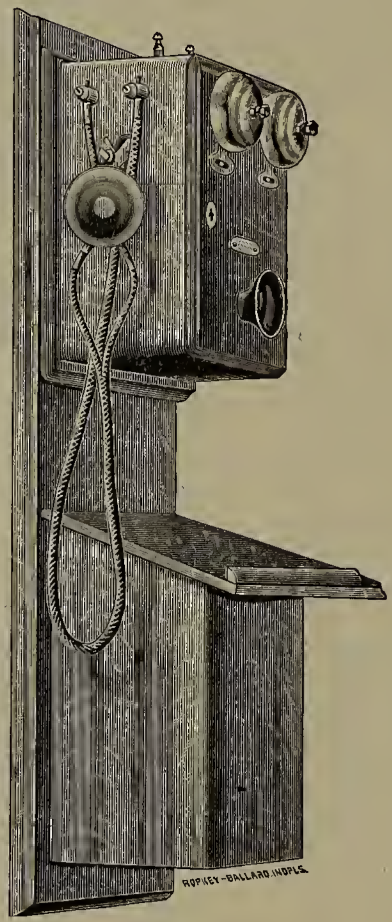


FIG. 1.

the electrodes apart in loud speaking is effectually overcome, the exact modulations of the sound waves being faithfully transmitted.

The instrument is very simple in construction, and does not require the services of an expert to keep it in order. It is built entirely on a metal base, which avoids the difficulties resulting from warping and shrinking. The entire working system is made of metal, except the carbon contact, which is of the finest grade of carbon obtainable.

Fig. 4 gives a perspective view of the construction of the transmitter.

Fig. 1 shows the model "B" telephone as made by the Universal Telephone Company. The transmitter is placed in the magneto box, and this style of instrument is recommended for situations where a compact form is desirable.

The model "A" instrument has an independent transmitter box, between the magneto and battery boxes, as in the ordinary wall set. These instruments are constructed in the very best manner possible, and of the best obtainable materials. The magnetos are capable of ringing

through 10,000 ohms resistance. The receiver is made in the form either of a watch-case or of the standard Bell pattern, and the semi-automatic switch is provided with platinum contact points.

Fig. 2 shows an instrument made especially for use in factories, offices, hotels, and residences, or any other short distances. It is very compact, being only 4″ by 5″ by 2″ in depth, and fitted with either bell movement or buzzer. It is provided with the company's semi-automatic switch, and a push button for ringing-up. For short lines

FIG. 2.

this instrument gives excellent satisfaction. It is well made and serviceable.

The patents on these instruments have been in force ten years, and are said to antedate the existing patents on all other telephones now on the market.

The Universal Telephone Company does not intend to operate exchanges. It will simply manufacture the instruments and sell them outright.

A test line was constructed in the Talbott Block, In-

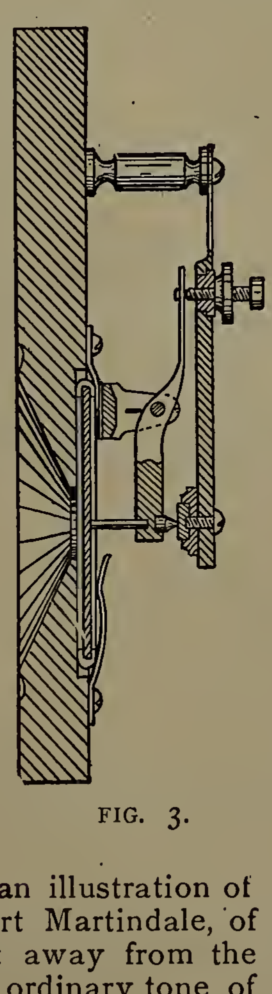


FIG. 3.

dianapolis, and as an illustration of what the instrument could do Mr. Robert Martindale, of the company, sat in a chair twelve feet away from the transmitter and his conversation, in an ordinary tone of voice, was distinctly heard at the other end of the line. It is claimed that this is not possible with any other transmitter.

TELEPHONE EXCHANGE.

The Harrison Electric Company, Chicago, has published, under the title "Telephone Exchange," a practical guide and handbook for managing and maintaining telephone exchanges. E. M. Harrison, M.D. and E.E., is the author of the work. The contents of the book, no doubt, will be found valuable to those interested. At the back are given lists of construction material for exchanges of various sizes; also valuable reference tables.

TELEGRAPHY BY INDUCTION.

The submarine cable between Scotland and the Isle of Mull was recently broken for a week, but electric communication between the island and the mainland was maintained by means of an induction apparatus. The distance

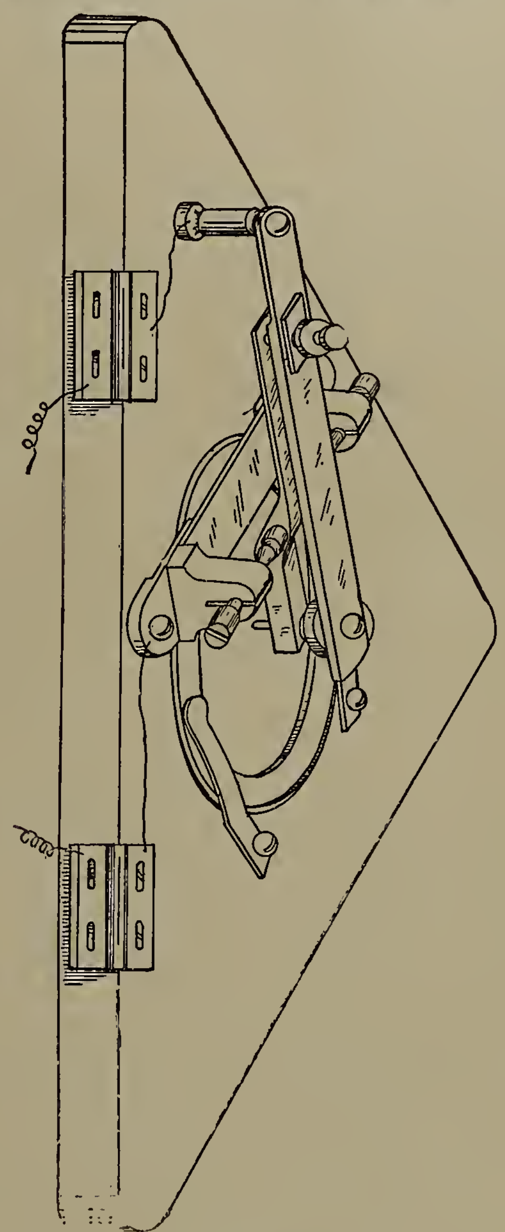


FIG. 4.

from the mainland is two miles. There were already wires along the island coast. A parallel line was constructed on the mainland coast, and messages sent over it were read by a telephone connected with the wire on the island, and vice versa.

Lecture by Mr. Joseph Sachs.—Mr. Sachs will, on Friday May 3, deliver a lecture before the Department of Electricity, Brooklyn Institute of Arts and Sciences, on the subject of "Cooking and Heating and Metal Working by Electricity." The lecture will be given at the Edison Building, 360 Pearl street, at 8 P. M., and will be illustrated by practical experiments and apparatus.

—Only one-twentieth of the electrical energy supplied to an incandescent lamp appears as light.

—All good conductors are opaque to light waves, although the converse is not true.

POWER CONSUMED ON ELECTRIC RAILWAYS.*

BY G. PELLISSIER.

What power capacity should be given to an electric railway motor is one of the first questions which presents itself in studying electric traction. If the motor be too small to satisfy the demands put upon it, it will be constantly breaking down and will require many repairs, as was shown in the early American practice when motors of seven and a half horse-power were employed. On the other hand, if the motor be too powerful these inconveniences will not occur, but the cost of installation and operation will be larger than necessary, so that either way loss will result. The best plan is to employ a motor of the right power capacity for the work. A different motor cannot, of course, be designed for each railway, but manufacturers are generally building motors of 15, 20, 25, 30 and even 50 H. P. capacity, and from these a choice can be made of the size best adapted for the work under consideration.

The power necessary to overcome rolling friction on straight, level track is, first, independent of the speed; second, independent of the length of contact, and third, proportional to the weight, the ratio being constant for similar bodies under similar conditions.

The third proposition is generally accepted by all who have given much thought to the subject, although the experiments recently made on the lines of the Eastern Railway by M. L. Legray, show that the resistance per ton diminishes very slowly as the weight increases. The two others are not always accepted. In practice these differences can be neglected without sensibly affecting the result, and if we represent the tractive effort by f, we have the formula $f=pF$, in which F is the weight in tons of the vehicle, and p a coefficient whose value depends upon the nature of the surfaces in contact. We will adopt as the average value of p 11.6 kilograms per metric ton in the following calculations. According to Mr. Reckenzaun, less power is required after a heavy rainstorm, and on the other hand, tractive effort is increased by snow on the track.

The power, P, required to maintain the speed of a vehicle on a level is proportional to the rate of speed, or the power $P=pFv$, where v equals velocity.

It should be stated that the track is never absolutely rigid, and there are produced during the passage of the car undulations in the track, which react on the wheels and cause a loss of work corresponding to an additional resistance, which should be added to those given above. According to the experiments, the results of which were made public in 1879 by a committee of the American Society of Civil Engineers, the resistance to movement produced by the oscillation of railway cars is about 250 grammes per metric ton, at a speed of sixteen kilometers an hour. This increases proportionally to the square of the speed and is far from being negligible.

If a constant speed is maintained about a curve the motors exert a power more considerable than one would at first believe. In America, with long cars mounted on bogie trucks with standard gauge, a resistance can be allowed of ..2 kilogram per ton per degree of curvature, and this increases proportionately to the degree of curvature.

On tramways, where the curves are always of short radius, the importance of this additional resistance is considerable. According to Mr. Reckenzaun, in passing around a curve of fifty feet radius the resistance to traction is doubled and often trebled, if there should be sand on the rails. This increase, however, does not largely affect the load on the central station, for it is customary to pass around curves at a low rate of speed on account of fear of accidents, danger of derailment, etc. The power required at curves can also be greatly decreased by wetting or greasing the inner rail, as Messrs. Shepardson & Burch have shown by some interesting experiments.

The resistance of the air is usually neglected at ordinary speeds.

The conditions to be taken into account are: first, the speed; second, the surface presented to the air; third, the form of body.

According to Newton, the resistance presented by a surface is proportional to the square of the speed, that is, $r=aV^2$, in which a is a numerical coefficient equal to the resistance experienced by a surface of one square meter moving normally in its plane at a rate of one meter per second. For air in quiesence, a, equals about .08. On the other hand, other investigators give different laws, as for instance, O. T. Crosby, who has shown that at speeds between 48 and 210 km. per hour the resistance is directly proportional to the speed.

When a car is on an inclined plane the tractive effort is somewhat diminished, because the pressure at right angles to the rails is not equal to the weight of the car, but to $F \cos \theta$, θ being the angle of the grade. In the limits of practice this effect is negligible, since for an angle of 15 degrees the reduction is only 4 per cent. In order to overcome the action of the grade during the ascent, the motor ought to develop a power equal to $1{,}000\, F \sin \theta$, which should be added to the other efforts which we have already analyzed. F, it will be remembered, indicated metric tons, each of which equals 1,000 kilograms. This is positive during the ascent of the grades, and negative during descent.

The power required is proportional to the product of $1{,}000\, F \sin \theta$ by the speed v. It is also desirable to know the approximate value in terms of the linear distance. Assuming that the distance covered on the grade is approximately equal to its horizontal projection, we have as an expression for the power $1{,}000\, Fvh$, h being the grade in centimeters per meter. Under these conditions the power necessary to overcome the resistance of the grade and the resistance to rolling is equal to $F(p + 1{,}000\, h)\, v$.

The effort necessary to overcome the grade increases somewhat more than proportionately to the tangent of the angle of the grade, and there comes a time when, as the grade increases, the effort is so considerable that it is not possible to propel the car by the adhesion between the rails and the wheels, and these slip. When the car descends a grade, the action of the latter, on the contrary, tends to give the car a uniform accelerating movement. When the grade is so steep that $1{,}000\, F \sin \theta$ is greater than the total resistance to rolling, the car will descend by itself, and the speed, after a certain distance, can become so great as to be dangerous.

In the case of tramways, where the cars may have to stop at other points than those at which passengers mount or leave the cars, the question of starting becomes important. In order to give the best service, a tram car ought to be able at the moment of starting to gain in a very short time its regular speed, otherwise a large amount of time will be lost. Under these conditions the power absorbed in overcoming the inertia of the car is considerable. Suppose that a car of the weight, F, in order to gain its regular speed, v, requires to pass over a distance of l meter, the average acceleration given by the formula

$$A = \frac{v^2}{2\, l},$$

and the time employed will be

$$t = \frac{2\, l}{v}$$

Under these conditions the average effort will be 1,000

$$\frac{F}{g}\;\frac{v^2}{2\, l}$$

and the average power needed will be 1,000

$$\frac{F}{g}\;\frac{v^3}{4\, l}$$

* l'Industrie Electrique.

These formulæ presuppose that the acceleration is constant, which is not exactly true, since at the moment of starting on electric roads the resistance of the circuit is successfully diminished, and consequently the power increased by steps of the controller. For each position of the latter, the acceleration is constant.

We are now able to estimate the total effort or force necessary at any time to move a car. It is equal to all the separate forces which we have analyzed. v being the maximum speed, we will have for the total force at starting

$$f = F(p + 1{,}000\,h) + 0.08\,S\,\frac{v^2}{4} + 1{,}000\,\frac{F}{g}\,\frac{v^2}{l}$$

Power required:

$$P = F(p + 1{,}000\,h)\,\frac{v}{2} + 0.08\,S\,\frac{v^3}{8} + 1{,}000\,\frac{F}{g}\,\frac{v^3}{4\,l}$$

Total force when operating at a constant speed:

$$f = F(p + 1{,}000\,h) + 0.08\,S\,v^2.$$

Power required:

$$P = F(p + 1{,}000\,h)\,v + 0.08\,S\,v^3.$$

LOCAL ACTION IN ACCUMULATORS.

BY G. DARRIEUS.

It is undeniable that the actions called local play a very important part in the accumulator, as indeed in any voltaic combination. It is known that they act upon the same electrode, and are due to want of homogeneousness in the metal or material forming this electrode, which gives rise, as a consequence, to the formation of elementary voltaic couples, having a very powerful action, owing to the circuit of these couples having practically no resistance.

The result is that there is a consumption of the material forming the battery, without any profit as regards electrical energy. If we take, for instance, the zinc battery, we know that zinc which is chemically pure does not decompose cold water, or, at any rate, only very slightly. This is not the case, however, with the zinc of commerce, which, if plunged into water very slightly acidulated, is very violently attacked.

This difference is attributable to the presence in the zinc of commerce of various impurities, especially lead, which, together with the zinc, create a voltaic couple closed in short circuit

It is interesting to remember that this phenomenon was the starting-point of a system of accumulators, now forgotten, invented by M. D. Monnier, and which was obtained by forming an alloy of lead and zinc in definite proportions, and then attacking it with an acid; when the zinc had disappeared a mass of spongy lead was left. In the case of the battery, the whole of the zinc dissolved by local action is consumed at sheer loss, and this is the very serious defect alluded to when we say of a voltaic combination that it expends or does not expend on open circuit.

There are many different kinds of local action, it is observable, not only upon contact between the zinc and the liquid, but it may be set up between two liquids, or even in one only; it is in this way that the Bunsen battery, the nitric acid of which should be reduced to bioxide of nitrogen, gives off hyponitric acid in consequence of the reaction between the two first bodies. In the same way the bichromate sulphuric solution of the Poggendorff battery, if prepared too long beforehand, slowly decomposes. It is these various local actions that we propose to study in the accumulator.

We will first examine the composition of the accumulator, in order to form an idea of what kind of local action may be expected; for this purpose, we will analyze each electrode separately.

In the type of industrial accumulator now most generally adopted, the active material of the plates is applied by some process or other, either being spread on in the form of a paste, or attached by igneous fusion to a conducting support formed of an alloy of lead and antimony.

The object of this support, which is generally made in the form of a grid, is to distribute the current through the mass of active material, and it should not participate in the electrolytic action. The alloy of which it is composed should, therefore, be as little oxidizable as possible.

On the positive plate we shall thus get peroxide of lead on a grid of antimonious lead, and it can easily be seen that this heterogeneous mixture will develop a couple.

In short, by plunging into water containing sulphuric acid a small plate consisting only of peroxide solidified by compression and a portion of the grid, we get an electromotive force of 1.40 volts.

From these figures we draw a curious conclusion, viz., the peroxide of lead prepared in any manner, and spread directly on a new grid, cannot give in the presence of a negative of spongy lead the normal electromotive force of the accumulator.

If, in fact, we subject a similar couple to measurement, we get for the electromotive force .85 volt, a very variable value.

This low value explains how it is that certain experimentalists, having proceeded as described above, have thought themselves justified in concluding that the positive active material of the accumulator was not peroxide of lead.

Now, without taking into account chemical analyses which prove the absolute identity of the positive material with peroxide, we can arrive at the same conclusions by means of the following experiment:

Into a little platinum capsule we put successively a small quantity of peroxide, obtained chemically, and then some electrolytic peroxide, and after having plunged the capsule into the acidulated water, with the same negative, we measure the electromotive forces; we find in both cases exactly the same value, 2.05 volts. The couple described above as being set up between the peroxide and the grid at once gives rise to a disturbing local action, in that it produces a lowering of the electromotive force.

There can be no doubt as to this being the case; to verify it we have only, before applying the peroxide to the grid, to oxidize the latter by plunging it into a boiling solution of hyposulphite of sodium; a superficial peroxidization is produced which is sufficient to cause the positive plate formed with this grid to give 1.65 volts in the presence of a negative.

The chemical action here is limited, but if the grid is peroxidized by chemical means, and used as an anode before being spread with the paste, the plate gives with the same negative the normal electromotive force, 1.95 volts.

Other couples giving rise to local action are also generated in the very midst of the positive active material during the working.

We know, in short, that the principal reactions of the discharge have the effect of reducing the peroxide, which is brought back to a lower degree of oxidization. Now, whatever may be the limit of this deoxidization, there must exist a difference of potential between the peroxide which is not reduced and this weaker oxide. This is, in fact, clearly shown by the measurements taken after introducing in succession into the acidulated water peroxide and minium and peroxide and litharge. The electromotive forces of these couples are, respectively, .85 and 1.04 volts.

In the Planté couples there is also local action between the peroxide and the subjacent soft lead, and Planté utilized it to accelerate the formation. On the negative plate, when well charged, we have present spongy lead, and a support in the form of a grid, acting as conductor, composed of antimonious lead; we know from our former researches that there exists a difference of potential between the soft lead and the spongy lead; this should also be the case with the alloy forming the grid. If, in fact, we measure the electromotive force between a grid of antimonious lead and a paste of spongy lead, we get .52 volt.

This couple, when short circuited, in which the active material is the negative, has the effect of accelerating the oxidization of the spongy lead already produced by the mere immersion of the reduced lead into the acid liquid.

Lead in this peculiar molecular condition, being very active, decomposes cold water, and these two effects, one galvanic and one purely chemical, bring about the oxidization of this active material. A similar action is set up in plates of the Planté type.

To these two causes together is due the slow but regular disengagement of bubbles of hydrogen on the negative plates of an accumulator at rest, which everyone that has manipulated these apparatus must have noticed. To this cause also is due the loss of charge, increasing as time goes on, in an apparatus on open circuit, supposed to be well insulated.

The electromotive forces of the different local couples which may exist in the electrodes in the course of the working of an accumulator are shown in the following table :

Positives.	Positives.			
	Peroxide of lead.	Litharge	Alloy of lead and antimony	Soft lead.
	Volts.	Volts.	Volts.	Volts.
Litharge	1.04	...	...	...
Alloy of lead and antimony	1.40	0.033	...	...
Soft lead	1.46	0.085	0.065	...
Spongy lead	1.94	0.51	0.52	0.46

In this too brief article I have tried to show that the local actions in the secondary couples are manifold, and that they are inherent to the physical structure of the electrodes. It is these parasitic actions that often mask the principal phenomena, and render experimental researches more difficult.

Is it not time to do something for these poor accumulators, which have been so decried and vilified, but which, nevertheless are faithful servants when we know how to treat them ?

"They Have Ears Yet They Hear Not."—A lecture on "Electricity" was recently delivered before the inmates of the Hull (England) Deaf and Dumb Asylum.

To Reduce the Cost of Light. — A bill has been reported favorably by the Cities Committee of the New York Assembly providing for the reduction in the price of gas and electricity in New York, Brooklyn and Buffalo.

Telephony in Germany.—There are more telephones in Berlin alone than in the whole of France, according to an official statement before the German Diet. In the whole of Germany there are 84,920 instruments.

Personal.—Mr. R. L. Weithas, of the business department of the *Electrical World*, has severed his connection with that paper to accept the position of secretary and manager of the Consolidated Advance News Bureau, Western Union Building. Mr. Weithas, we understand, has acquired a proprietary interest in the latter named concern.

Telegraphy Self-Taught.—Mr. F. E. Wessels, of West Ridley Park, Pa., has recently published a monograph, entitled, "Practical Telegraphy." It is intended to aid in self-instruction of telegraphy. It brings telegraph practice up to date, and includes a chapter on the typewriter in telegraphy, and one on the use of Phillips' code of abbreviations in the transmission of press dispatches. The price of the little work is 50 cents.

—A street-car equipped with a 3-phase motor, said to be the first one so fitted, was exhibited by Siemens & Halske, at the World's Fair. The motor was of the 4-pole type, of 20-h. p. nominal, but capable of working up to 60-h. p., at 500 or 600 volts, at 1,400 revolutions. The reduction gear was enclosed in oil.

SUPERHEATING.*

BY W. H. BOOTH.

Were it attempted to explain the economy of superheating as due to the large amount of heat introduced to the cylinder, the attempt would prove an utter failure, yet superheating will give an economy of 20 to 30 per cent. in steam consumption, which is singularly near to the 20 to 30 per cent. of initial condensation that is suffered by saturated steam entering the cylinder. To understand the action of superheating and to realize that it is not to the quantity of extra heat in the steam that the economy is directly due, let a pound of steam be taken and its behavior traced through the cylinder. The pressure shall be taken as about 100 lbs. on the gauge. The temperature of such steam is 338° F., and its latent heat is 875 units. Admitted into a cylinder one-fourth of this pound of steam condenses, and by the time the cylinder, by which will be understood of course the inner surface film of metal which changes temperature, has attained a temperature of 338°, there will be present in the cylinder three-quarters of a pound of steam at 338° and one-quarter pound of water at 338°, while the cylinder has absorbed the 219° units of heat set free by the liquefaction of this quarter pound. If the specific heat of steam be taken as 480, then to furnish 219 units of heat by means of superheated steam will call for 219 ÷ .480 or 456° of temperature. Hence the total temperature to heat the cylinder to 338° would be 794°, or the steam would be rapidly approaching a red heat, yet it would start on its duty of expansion at only 338°, and saturated, for all its superheat would be absorbed by the cylinder. Neglecting for the moment any condensation due to conversion of heat into work, and assuming that dry exhaust steam abstracts no heat from the cylinder, and it would follow that the sudden admission of steam superheated to 794° would cause a dry exhaust and leave the cylinder as hot as the saturated steam previously employed, namely, 338°, and if only saturated steam were employed at the next stroke, none of it would condense, and there could be no cooling of the cylinder by re-evaporative effects. If this position be reasoned out it will be found that, still adhering to the two false assumptions named, any small degree of superheat would prevent condensation, its effect continuing from stroke to stroke. Thus the half of the above 219 units might be supposed to be added at one stroke; this would halve the condensation and halve the subsequent re-evaporation, and the cylinder would only be cooled to one-half its previous extent when using saturated steam. Then, upon a second stroke, and still adding the same superheat, the cylinder would attain steam temperature without causing condensation, and, after this point, the exhaust would be superheated, and so the addition of any fractional amount $= \frac{1}{x}$ of the whole missing heat would, in x strokes, produce dryness. But in practice there are to be dealt with (a) the loss of heat by conversion to work; (b) the absorption of heat by the exhaust even when this is dry. In an engine working with 16½ lbs. of steam per H.P. hour, and expanding to half an atmosphere final pressure 1 lb. of steam will perform obviously 120,000 foot-pounds of work, and to do this there must disappear 155 heat units. As the total heat of a pound of steam at half an atmosphere or 180°, and 338° only differs by about 48 units, the remaining 107 units must come from latent heat, and the value of the latent heat of steam at 180° is 988 units. Approximately .1083 of the steam thus disappears in the performance of work. More heat disappears in re-evaporating the steam thus condensed; this last heat comes out of the cylinder, which must, therefore, supply 107 units per pound of steam used, apart from anything further it may radiate to the exhaust. Probably this latter will be but small in amount, if, therefore, the initial steam be superheated to the extent of 107 units, or, say, to 223° F., it will be in a position to furnish all the heat necessary for the performance of work without any initial condensa-

* *Electrical Review*, London.

tion, for, no steam being condensed during expansion, the cylinder will exert no re-evaporative effects and will, apart from radiation losses, be at full temperature to receive initial steam. The necessary temperature for the case in point is thus 338° + 223°, or 561°. But even this temperature may be excessive, and the figures simply show that, where superheaters are used, the steam is, nevertheless, always in a saturated condition in the cylinder, and they point further to the fact that the jacket and superheater may, where the mechanical conditions as to speed justify the practice, be combined in one engine, the superheater alone being insufficient to supply the heat required to produce dryness. How, it may be asked, are the 20 and 30 per cents. of economy realized that Prof. Unwin considers the Alsatian experiments to show. Very simply, indeed. There is a vast difference between condensation by cylinder action and condensation by performance of work. In the first case the water is all formed on the cylinder surfaces; it adheres to these until boiled off, when the pressure falls. In the second case water is formed throughout the body of the steam as this expands with performance of work, and some of this water never touches the cylinder, nor does it receive sufficient heat by radiation from the cylinder to re-evaporate it; it passes *as water* to the condenser and carries no latent heat with it. In place of the nominal amount of 223° of superheat being necessary, something very much less may be, and no doubt is, quite sufficient to realize all the economy claimed for superheating, and this will be the case preferably in such engines as have a very short stroke-duration. The conclusion to be drawn would appear to be in favor of a moderate though decidedly pronounced degree of superheating combined in slow moving engines with the jacket. When, however, the exhaust from the last cylinder begins to show any superheat—a doubtful possibility—then the additions of heat to the working fluid have gone past the limits of economy, probably to a considerable degree, for some mistiness of the exhaust would appear justifiable if due to work effects. So far as any tests yet published may be taken to show the average performance of the McPhail design of superheater, they show that it is scarcely to be designated as other than an efficient steam dryer and an excellent additional heating surface and preventer of priming. This follows naturally on the system employed of passing the steam pipe through the water space, and may be taken to show that this latter is overdone, and that all the steam should not be so treated, merely so much as may be found requisite to reduce the overheated condition of the portion taken direct from the superheated tubes to the engine. In most cases in practice of ordinary engines it is very unlikely that there is really absolute dryness secured by superheating. Such degrees of superheat as have yet been dared are not enough to do more than reduce initial condensation, so that, after all, the working steam is still saturated.

CORROSION OF BOILERS.

BY WM. C. WARD.

In an article in *Cassier's Magazine* for April, under the head of "Corrosion of Boilers and Steamships," Mr. Ward gives some facts of special interest to electric light and power station managers, regarding the corrosion of boilers in general. They show the importance of care in the election of lubricants. Referring to the deterioration of boilers, Mr. Ward says:

"General wasting or pitting is caused by chemical and electrical action. These actions may be induced by the lubricant used on the engine finding its way into the boiler; air or oxygen dissolved in the water; mill-scale carbon, or oxides of the metal being present; difference of temperature of the metals, and want of homogeneity in the metal.

"With triple-expansion engines the majority of lubricants are at once vaporized in the high-pressure valve chest or cylinder, and pass with the steam into the condenser, there to be taken up with the feed-water and pumped into the boiler. It is well known that animal or vegetable oils, when decomposed or oxidized, produce acids; hence such oils must never be used for internal lubrication of steam-engines. None but the best mineral oils (pure hydrocarbons) having a high vaporizing point, should be used."

Many of the Clyde and Tyne shipbuilding firms, the author says, are building engines in which no internal lubrication is used. Triple expansion engines of 5,000 H. P. have run for years without any injury.

FELLING TREES BY ELECTRICITY.

The days of the wood-chopper are numbered, and the sound of the axe as it reverberates among the trees in the forest will soon be lulled into a sleep from which there will be no waking. The poets will have to look elsewhere in nature for inspiration and themes, and the light-hearted axeman will of necessity be compelled to earn his daily bread in other fields of labor.

Mr. Gladstone, England's "Grand Old Man," may soon be brought face to face with the tremendous fact that there are no more trees left for him to fell, and the vender of "chips" from the monarchs of the vegetable kingdom felled by that distinguished gentleman will pass forevermore into oblivion. But why all this change? Has some "prophet" away from home predicted that the world with all its grand forests and other sublime products of nature is to pass from the light into the shadow? No; a little platinum wire which will devour an electric current and get red hot in the process is going to bring about these changes—electricity, the leveller of all things.

This will be a world of "electricians" before many more years have rolled by; the butcher, the baker, the candlestickmaker, the car driver, the gas lighter, the hod carrier, jack tar, and all the rest of humanity, will be electricians of some calibre.

But the little platinum wire will take a great tree in its tender embrace, and with deadly grip will, in a few minutes, fell the giant to earth. Another proposed plan of utilizing the wire is to stretch it in a straight line, bring it to a white heat by the electric current and apply it to the tree as we do an ordinary saw.

In England, trees on several estates have been felled in this way, and quickly. Many advantages are claimed for this method. The waste in sawdust is avoided, and the incidental charring of the cut surfaces of the timber is said to prevent decay, thus increasing the value of the wood. Eight trees, it is said, can be brought down by this process in the time now required to cut one down by axe or saw.

Truly electricity will conquer the world!

ABOUT LIGHTING RAILROAD CARS.

EDITOR ELECTRICAL AGE: How are we to get correct information in respect to things electrical in departments where improvements are constantly being made, or at least where efforts are being constantly put forth to that end? The writer is in a state of harassing doubt over a matter in which we all have an interest, more or less direct—I mean the matter of lighting railway and street cars.

A very interesting and detailed account of the cost of lighting passenger trains on one of the prominent railroad routes is given in your issues of July 28 and Aug. 4, 1894. It is there shown that by the storage battery system, in the year of 1893, the cost, all told, was about $\frac{82}{100}$ cents per lamp-hour, which is a most satisfactory result. But now comes our trouble: From another source we get a detailed account of the cost of lighting cars on the same road. The latter account shows that by the same storage battery system the cost is $2\frac{17}{100}$ cents per lamp-hour. Both parties speak with apparent candor, and claim accurate information. The difference in the statements of cost of plant, equipment, depreciation, etc., is small, but the

result in the two are so wide apart that we do not know what to do. So we appeal to you, Mr. Editor, hoping you may show "where we are at" in this matter. Should you kindly do so, you will deserve to be regarded as a public benefactor.

We think the ideal lighting system is yet to come. The nearest approach to it we know of is about as follows:

Batteries must be used; we think that much can be safely affirmed. Has a battery been invented that cannot be materially improved? Can there be (say) a 200 ampere-hour battery constructed that will weigh about one-half as much as the best now in use? We will answer that in the affirmative.

How many cells of such a battery will be required to furnish the needed 148 C. P. to light a passenger car? The answer is 15 cells.

Can such a 200 ampere-hour cell be constructed with any metals now known so as to generate its own current and the usual voltage (two volts to the cell), and with rate of discharge that shall be constant, and supply current for 148 C. P. continuously during the time of its rated capacity —one that will require but little time to replenish, so as to avoid duplicating sets, as is now necessary, and also avoid the construction of expensive plants and machinery? If all this can be done, and there be no obstacle of any nature in the way that might be regarded as serious, we might claim that the ideal means of car-lighting had been found. The 15 cells should not weigh over 450 pounds, and the maintenance sufficiently light in labor and cheap in cost to secure their extensive adoption. What is here indicated is now really accomplished, and we will add that the improvement in lamps has contributed to the result in a considerable degree. The writer is in possession of the real facts in the case, and the public soon will be.

Very respectfully yours, W. H. O.

[Note.—The statements referred to by our correspondent were contained, first, in a paper read by M. B. Leonard, at the convention of the Railway Telegraph Superintendents, Detroit, June 14, 1894; and, second, in the "Digest" of the *Electrical World* at the end of the same year. The "Digest" was based on an article in the *Engineering News* of December 20, 1894. In several particulars there is a wide difference between the figures of the two authorities. According to Mr. Leonard the cost of the equipment of 33 cars was $1,641.70, while, for 41 cars, according to the second source of information, the equipment cost was $3,000. The total operating expenses for July, 1894, according to the "Digest," was $2,300, or $27,600 for the year; while for the entire year 1893, according to Mr. Leonard's report, the total operating expense was $11,-373.41, a difference for the year of $16,226.59. It must be noted that Mr. Leonard's figures cover the period of one year, while those given in the "Digest" represent the operation for one month—July. In the latter case, however, the cost for the year, on the same basis, is easily ascertained, showing it to be $27,600, as above. How to account for the vast differences between the charges for the two items by the different authorities is beyond our ability at this time. Perhaps the authors of the information in these two cases can reconcile them, and thereby rescue our correspondent and many others from the sea of doubt and perplexity.—The Editor.]

GENERAL ELECTRIC'S TAXES.

Justice Russell of the Supreme Court has decided that Schenectady is the legal residence for the purposes of taxation of the General Electric Company, the Edison General Electric Company, and the Edison Electric Light Company. The companies paid personal taxes in New York county in 1893. The three companies obtained writs of certiorari to review their assessments for the year 1894. They set up that New York county had no right to tax them, and that if it had the amounts imposed were excessive. The General Electric Company was first assessed for $50,000,000, but on appeal to the Commissioners of Personal Taxes the assessment was cut down to $9,776,934, the tax on this amount being $163,000. The company had paid taxes on an assessment for this sum in 1893.

The company was incorporated under special act of the Legislature in April, 1892. It was then resolved that the principal office for the transaction of its business should be in Schenectady, but that it should have an office in this city. In October, 1893, it was resolved that the general executive, financial and business offices should be at Boston, but it maintained its offices and manufactory at Schenectady, removing its office from New York to that town. Its directors hold their meetings in Schenectady.

The Edison General Electric Company and the Edison Electric Light Company also decided that their principal offices should be in Schenectady, and they were to have branch offices in this city.

MUNICIPAL FOLLY.

NEW YORK HAS GIVEN AWAY MANY OF ITS MOST VALUABLE FRANCHISES.

The time has come to call a halt upon the granting of public franchises in this way. If New York City cannot itself undertake to operate its street railroads, and if it is not practicable, or if it is deemed unwise that it should supply gas and electricity, certainly it cannot be urged that it should give away these valuable franchises without adequate return; and adequate return can be secured only by granting these privileges to private companies for a limited time, and requiring that at the end of a stated period—not exceeding, say, twenty-one years—there shall be a revision of the compensation to be paid to the city.

The net earnings of any street railroad or gas company, or even now of any electric light company, are so well assured that there is no doubt capital would enter into them even under severe restrictions. This is also true of the telephone business.

This is not a new principle, but only the application to these privileges of the practice that has always prevailed in regard to the city's docks, piers, markets, and ferries. The city of New York has wisely retained the ultimate control of its own water-front, and by a readjustment every year of rentals for its docks and piers, and at longer intervals of its ferry privileges, it is deriving the benefit of municipal growth and expansion from these sources. The result is gratifying, even though millions may have been lost by official negligence or corruption. The utmost advantage can at any time be obtained by the city by greater economy and watchfulness on the part of its public officials.

These figures of increased revenue will carry conviction of the value of public franchises in New York City. The Dock Department was organized in 1870, and since then its gross annual revenues have shown an increase from $315,524, in 1871, to $1,839,658 for the year 1894, and its net yearly revenues, which in 1871 amounted to $143,000, had increased twenty-three years later to $1,500,000. The ferry rents, which in the year 1879 were only $64,441, have been increased to $354,280.

We need only record the earnings of the Brooklyn Bridge to realize what has been gained to present and future generations by retaining in public hands the control and ownership of this great highway. The gross earnings have steadily increased from $622,680.31, in 1885, to $1,326,-598.85 in 1894.

The profits from public enterprises are so well assured that the public should be continually on guard. Only a few years ago practically an exclusive contract for underground subways was authorized by the Legislature, without substantial cousideration to the city, which will make it almost impossible ever to interfere with the monopoly of the Metropolitan Telephone, the Western Union, and the Edison Illuminating Companies, the virtual owners of this new corporation controlling the subways.—A. C. Bernheim in the *Century* for May.

—The rent derived from telegraph and telephone wires across the Brooklyn Bridge amounts to $13,000 a year.

BASE-BALL BY ELECTRICITY.

Enthusiasm over base-ball has revived with extraordinary vigor, coincident with the opening of the base-ball season, and thousands of the lovers of the sport are now engaged in speculating as to how they can see the greatest number of games this season. Very few of these can enjoy the unspeakable pleasure of personal attendance at many of the matches owing to the barrier of distance. But in these days of the utilization of electricity to all of man's needs, even distance has been overcome, and one may enjoy at home a reproduction of a ball game played in any distant city.

The name of M. D. Compton is becoming intimately associated with league base-ball through his system of reproducing on the stage of a hall games played in any other city. We have described this system in previous issues of the ELECTRICAL AGE, and those of our readers who wish to acquaint themselves with its details can find the same in the ELECTRICAL AGE of March 9, 1895, page 140.

In brief, Mr. Compton reproduces faithfully a game of base-ball played at a distant point. Every change in the actual situation on the field is accurately and instantly recorded visibly, and to all intents and purposes it is as pleasurable to witness a game reproduced in this manner as it is to be present on the field of action.

The Compton Electric Service Co., Postal Building, New York, owns the system, and is making great preparation for its extensive use this season.

On April 18 the first game of the season was presented before an audience of 2,500 people in the Academy of Music, Philadelphia, and the enthusiasm was unbounded.

On May 1 Mr. Compton will entertain the Baltimoreans, and then move on the National Capital, where the President and his cabinet, all the government officers and thousands of other citizens in Washington, will have a chance to witness the national game played in other cities.

From Washington Mr. Compton will go to Pittsburgh, beginning operations in that city on May 28. On May 20 he will occupy Madison Square Garden, New York, and show the Gothamites how their home teams plays when away from home—they will be in St. Louis on that date.

On July 1 Mr. Compton will go to Atlantic City, and relieve the monotony of the song of the "breakers" by giving the wayfarers at that resort a taste of base-ball as reproduced by electricity.

When looking at a game of base-ball *a la* Compton, it is easy for one to forget that he is in a hall looking, not at a simulation of the game, but at the game itself. No wonder then that Mr. Compton's system is growing in popularity.

NEW YORK ELECTRICAL SOCIETY.

The 166th meeting of this society was held at Columbia College on the evening of Wednesday, April 24. Mr. Edward Durant gave a lecture on "The Manufacture, by Means of the Electrical Furnace, of Diamonds, Rubies, Aluminum and Calcium Carbide (Acetylene Gas)."

This meeting had been fixed for April 23, when Mr. T. L. Willson was to have delivered a lecture on "Acetylene." Mr. Willson was, however, compelled to leave for the West, at the last moment, and Mr. Durant kindly filled the gap, his lecture being a repetition of that given before the Brooklen Institute on April 16. Mr. Durant explained, in a unique manner, the method of producing the substances named, and exhibited samples of rubies and diamonds produced in the electrical furnace. The artificial stones are said to be equal in every respect to the natural. The lecturer also showed, on a small scale, how acetylene gas is produced. The gas was lighted, and although the jet was small, an intensely brilliant light was given. The products of the flame seemed, however, to give forth an odor that could hardly be classed as grateful to ordinary nostrils.

—All wires used in arc lighting are covered with braided and painted fireproof fibre.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

The annual meeting for the election of officers, and transaction of other business, will be held in New York City, Tuesday, May 14. The following named gentlemen are the council nominees for the various offices to be filled:

For president, Dr. Louis Duncan; for vice-presidents, Dr. Michael I. Pupin, W. F. C. Hasson, Angus S. Hibbard; for managers, Carl Hering, Bion J. Arnold, Charles F. Scott, Cary T. Hutchinson.

The general meeting for the reading and discussion of papers will be held at Niagara Falls, beginning June 18.

ROSE POLYTECHNIC INSTITUTE.

We have received a copy of the thirteenth annual catalogue of the Rose Polytechnic Institute, Terre Haute, Ind. It contains an outline of the course of study and the plan of instructions.

Among the studies is electrical engineering, in charge of Professors Gray and Mees, and Mr. Place. The electrical equipment consists of a 50 horse-power compound engine, with speed cones giving a range of speed from 200 to 2,500 revolutions per minute on the dynamo shaft; a 36,000 watt alternating current Westinghouse dynamo complete, with transformers of from 250 to 2,500 watts capacity of various voltages and manufactures, arranged for experimental work; a model lighting plant of 150 lamps, with switchboard and station instruments complete, a number of dynamos and motors of various sizes and types, series, shunt and compound wound; among these may be mentioned four 40 horse-power street car motors of different designs, donated by the General Electric Company. For use in experiments in connection with these, cradle and transmission dynamometers with registering apparatus of various kinds, tachometers, speed counters and measuring instruments of most approved form, suitable for both alternating and continuous currents.

A large experimental magnet, weighing about a ton, with laminated and adjustable cores, pole-pieces and coils for the study of magnetic induction, resistance and leakage, the comparison of dissipation of energy in open and closed circuit transf rmers, etc.

THE BROOKLYN ELECTRIC MFG. CO.

The Brooklyn Electric Mfg. Co., 351 & 353 Jay street, Brooklyn, N. Y., is happy in having all the business it can attend to. They are making some elegant switchboards to go to various plants. Among the most notable ones may be mentioned the following:

A white marble board, 7x10 feet in diameter, for the Presbyterian Building. This board will have a three-pole double-throw switch of 2,000 amperes capacity; 22 circuit switches; 2 Westinghouse automatic circuit-breakers; one Edison recording gauge; 2 Weston illuminated dial voltmeters, 2 ammeters of the same make and pattern and 2 Carpenter rheostats. It will be installed by Charles L. Eidlitz.

Another handsome board under way is of Tennessee marble, 7x26 feet, for the American Tract Society's new building. It is fitted with 42 switches, ranging from 50 to 2,000 amperes capacity, and the same number and make of recording instruments as in the former case. This board is supported by a massive bronze frame and will be installed by the Tucker Electrical Construction Co.

Two white Italian boards are being made for the Tucker Co. They are furnished with quick break and other switches, Weston instruments, Westinghouse circuit breakers and Carpenter rheostats. One of these boards is to go into the Prescott Building, New York, and the other is intended for the new Fidelity and Casualty Building, New York. Each is 5x8 feet.

A board 6x5 feet, fully furnished, is also being made for the New York Athletic Club ; also a board for the residence of Geo. Vanderbilt, at Biltmore, N. C.; 3 boards and 41 panels for Cornelius Vanderbilt's new house at Newport; boards for the dry-goods store of A. D. Matthews, Brooklyn, N. Y.; Buchtel's Brewery on Staten Island, and many others.

The Brooklyn Electric Mfg. Co. carries a large stock of copper parts for switches for immediate assembling. On March 16, the company had no less than 10,000 pounds of copper and brass castings on hand.

The factory covers a floor space of 9,375 square feet and there are 35 people employed. The company has ample facilities for filling orders for boards of any size—up to 5,000 amperes—within three weeks' time. Only the best of materials enter into the construction of these boards, and this company's goods are known all over the country for the excellence of construction and finish.

The company operates its own foundry for brass and copper castings, and a marbleizing department for the treating and finishing of slate for boards.

New York Notes.

Office of the Electrical Age,
World Building, New York,
April 29, 1895.

The Auerbach-Woolverton Electric Company has moved its office from the Cable building, this city, to 113 and 115 Adams street, Hoboken, N. J., where the factory is located.

Charles E. Chapin, 136 Liberty street, being unable to meet his obligations in full, and in order to protect all interests, made an assignment on April 29. He invites his creditors to meet him at his office at 2 P. M., May 3.

Henry B. Oakman and Harry M. Shaw, doing business as the Oakman Electric Company, manufacturers of electric specialties and supplies at 136 Liberty street, have made an assignment to Wm. D. Murray, of Plainfield, N. J.

The Gordon-Burnham Battery Co., which recently moved from Boston to New York, is making a special power battery that is highly spoken of in the trade. The company's office is in Room 507, No. 136 Liberty street.

On April 24 a test was made of the electric conduit road on Lenox avenue, with very satisfactory results. Several officials of the Metropolitan Traction Company were aboard the car which made the trial trip. The car ran very evenly, and seemed to fulfil every anticipation.

Mr. F. H. Briggs, 126 Liberty street, New York, is doing a good business in installing electric motors and dynamos. He gives special attention to repairing motors and dynamos and overhauling electrical installations. Mr. Briggs is successor to the firm of Briggs & Martin, which had its headquarters at 38 Cortlandt street.

Harry M. Shaw, formerly of the Oakman Electric Co., has opened an office in Room 105, Electrical Exchange, and will carry on a business as manufacturers' agent. Mr. Shaw has had an extensive experience in the electrical business, and is making specialties of the Universal non-arcing railway and central-station lightning arresters, Wagner transformers and fan motors.

Mrs. W. H. Gordon, widow of the late W. H. Gordon, who was a well-known electrical engineer and supply dealer of New York, is conducting the "New York Office Lunching Company," 110 Front street. Mrs. Gordon puts up a first-class lunch in a nice box and delivers the same to her patrons' offices for the small sum of ten cents. Mrs. Gordon's enterprise should be well patronized by the electrical fraternity. Her husband was a thirty-second degree Mason.

W. T. H.

Telephone Notes.

Wadsworth, O., will soon have a telephone exchange, steps having been taken with that end in view.

W. McC. White and others are trying to get a forty years' franchise for a telephone exchange in Butte City, Montana.

Steps are now taken in Burlington, N. C., looking to the establishment of a telephone exchange in that place.

A new telephone exchange is to be constructed in New Orleans by A. T. Moss, G. R. Penrose, W. P. Richardson, J. N. Stone and others.

Newly Organized Telephone Companies.—The Huntington Mutual Telephone Co., Huntington, W. Va.

Paris Telephone Co., Paris, Ky.

(For further particulars see "new corporation" column.)

TELEPHONE PATENTS ISSUED APRIL 23, 1895.

Telephone System. William Coonan, Jersey City, N. J. (No. 537,967).

Street Railway Notes.

It is proposed to change the gauge of the Columbus and Rome, (Ga.) narrow gauge road to the standard gauge and extend the lines. Electric power is to be used.

Senator J. Coyle, Chas. Drumm, and C. O. Smith, Muncy, Pa., are interested in a project to build an electric railway between Muncy, Hughesville and Picture Rocks, Pa.

It is reported that a company has been organized in Chicago to build an underground conduit electric road on Indiana avenue, in that city. The capital is stated to be $5,000,000.

Steps are being taken in Carthage, N. Y., to build an electric road from that place to Copenhagen, a distance of eight miles.

An electric railroad is proposed between Port Huron and Lexington, Mich. Edgar H. Brennan, of Toledo, O., is interested.

The Norristown and Perkiomen Railroad Company has applied for a franchise to build an electric road in Lower Providence, Pa.

The Troy City Railway Co., Troy, N. Y., has obtained permission to change the motive power on the Green Island and Cohoes line to electricity.

It is reported that the Pittsburgh, Greensburg and Latrobe Electric Railway Company will build a branch line from Latrobe to Ligonier, Pa. The general manager of the company can give further information.

Richard D. Fisher and others are trying to secure a franchise in Atlanta, Ga., for an electric railroad on certain streets in that city.

Edward M. Smith, civil engineer, Columbia, Pa., is surveying for the proposed electric railway from that city to Mount Joy.

It is reported that the Peoples' Electric Street Railway Co., of Pittsburgh, will extend its road from Freedom to Remington, Pa. The secretary of the company can give further information.

The clerk of the City Council, Toledo, O., can give information regarding the proposed electric road from that city to Sylvania.

There is talk of constructing an electric railway from Pekin to Metamora, Ill. Daniel Birket, of Pekin, is interested.

Possible Contracts.

It is proposed to establish an electric light plant in Marion, Va., to be operated by water-power.

O. Arnold, Bardstown, Ky., is interested in a project to build an electric light plant in that place.

The municipal electric light plant, Decatur, Ill., is to be enlarged. The secretary of the company can give further information.

Edward Pollock, of Lancaster, Wis., has obtained a franchise to build and operate an electric light and power plant in that place.

An addition is to be built to the Home for Aged and Infirm Hebrews, on Columbus avenue, New York City.

The City of Chattanooga, Tenn., is inviting bids up to June 3 next, for the erection of a municipal plant of 300 arc lights, also for lighting the city by electricity and supplying from 175 to 250 arc lights. J. O. Martin, chairman of the light committee, should be addressed for further particulars.

New buildings and other construction work which will probably require electrical plants and other electrical apparatus, are recorded as follows: new school house in Anderson, S. C. Tinsley & Wilson, Lynchburg, Va., architects; Bon Air Hotel, Atlanta Ga. Address Bon Air Hotel Co., Atlanta, Ga.; theatre in Atlanta, Ga., address Cotton States and International Exhibition Co. for further particulars; Court House, Paris, Texas; Y. M. C. A. building, Petersburg, Va.; warehouse, by C. G. Stifel, St. Louis, Mo.

It is reported that the Hackensack Electric Light Company, Hackensack, N. J., has sold its plant for $30,000 to the gas company of that place.

Steps are being taken in Roper City, N. C., to establish an electric light plant at that place.

The Paris Telephone Co., Paris, Ky., by H. A. Power, president, and Dr. H. H. Roberts, secretary and treasurer.

The Alvarado Water Supply and Electric Co., Alvarado, Texas, by M. Sansom, H. R. Jones, T. B. Pope, E. P. Reynolds and others. Capital stock, $10,000.

The Huntington Mutual Telephone Co., Huntington, W. Va., by H. E. Matthews, and others.

New Corporations.

The Standard Telephone & Electric Co., Minneapolis, Minn., by S. S. Kilvington, E. W. Batchelder, H. C. Dodge and G. L. Scott. Capital stock, $50,000.

The Cranford Mutual Telephone Co., Elizabeth, N. J., by Wm. J. Lansley, Henry C. Thornton, Joseph Waterman, Wilfred C. Allen, Geo. W. Littel, Jas. Rodgers. Capital stock, $10,000.

New York, Red Bank and Asbury Park Electric Railway, Red Bank, N. J., by Ivan Prowattain, Philadelphia, Jos. W. Robinson, Red Bank, and others. Capital stock, $500,000.

Atlantic Highlands, Red Bank and Long Branch Electric Railway Co., Red Bank, N. J., by David S. Arnott, Silas Dutcher, W. H. Hazard, S. S. Whitehouse, Benjamin Frick, Brooklyn; A. T. Allen, Hoboken; William T. Parker, Little Silver; William T. Corlies, Chas. B. Parsons, Arthur A. Patterson, Red Bank; Jas. Steen, Eatontown. Capital stock, $500,000.

Asbury Park Mutual Telephone Co., Asbury Park, N. J., by A. O. S. Haynes, Point Pleasant; Niait Rogers, Washington White, E. W. Bolles, Asbury Park; W. B. Goodenough, Farmingdale, and Wm. J. Lansley, Elizabeth Capital stock, $18,000.

Atlantic Coast Electric Railroad Co., Asbury Park, N. J., by Lawrence Fell, Orange; Wm. H. Hurst, John J. Walshe, J. Henry Haggerty, New York. Capital stock, $1,000,000.

Asbury Park Electric Co., Asbury Park, N. J., by Geo. A. Smock, Jas. M. Ralston, J. W. and Henry Rockafeller and others. Capital stock, $200,000.

The Mount Vernon Telephone and Messenger Company, to operate a line of electric telegraph or telephone to connect the towns, villages, cities, or other places within the county of Westchester. Capital $40,000. Directors: Horace Granfield, C. H. Ostrander, F. T. Davis, S. H. Gray, John Dawson, John Berry, and Wm. Archer, of Mount Vernon.

The Westchester and Williamsbridge Traction Company, to operate a street surface electric road between the villages of Westchester and Williamsbridge. Capital $60,000. Directors: G. P. Morgan, A. C. MacDonnell, and Charles F. Tracy, of New York city.

The Vineyard Haven Street Railway Co., Cottage City, Mass. Capital stock, $10,000.

The United Electric Telephone Company, New York City, by Norman C. Raaf, Frank R. Gannon, Henry Williamson, and others. Capital stock, $50,000.

The Vance Electric Company, New York City, by Arthur S. Vance, of Brooklyn; John H. Cheever, of New York City, and Chas. A. Allen, of Dover, N. J. Capital stock, $10,000.

The Eleetrolytic Insulating and Conduit Company, Springfield, Ill., by H. Clay Wilson and Jas. E. Henderson. Capital stock, $5,000,000.

The Bristol Gas and Electric Co., Bristol, Tenn., by Capt. J. H. Word, president.

The Pass Christian, Mississippi City, Handsboro and Biloxi Electric Railway Co., Mississippi City, Miss., by L. B. Mosely, president, and L. Dinkins, vice-president.

Trade Notes.

The New York Office Lunching Company's lunches, put up by Mrs. W. H. Gordon, widow of the late W. H. Gordon, are excellent, and used in our office. Mrs. Gordon's lunches should be taken by all electrical people. Her address is 110 Front street. Lunches delivered at your office.

The Interior Conduit and Insulation Company, New York, has just issued a seasonable catalogue of Lundell Fan-Motors of 1895 models. This company makes Lundell fan-motors for direct and alternating currents. All these machines are of handsome and compact design, and are applicable to any situation.

The Ferracute Machine Co., Bridgeton, N. J, has just issued catalogue No. 11, for 1895. It illustrates and describes new designs of foot and power presses, lathes, beaders, dies, etc., for working various kinds of bar and sheet metals. Over 300 sizes and kinds of presses are described and illustrated.

The Athens Plumbing and Electric Co. has opened offices at 220 Washington street, Athens, Ga. They will do an electric wiring business.

WOVEN WIRE BRUSHES.

The Belknap Motor Co., of Portland, Maine, are the patentees and manufacturers of the best woven wire commutator brush on the market.

ELECTRICAL and STREET RAILWAY PATENTS

Issued April 23, 1895.

537,829. Electric Alarm Clock. Henry W. Knapp and Lawrence E. Gerrety, St. Paul, Minn. Filed Oct. 25, 1894.

537,855. Electric Appliance for Elevators. James H. Roberts, Grand Rapids, Mich. Filed Oct. 6, 1894.

537,856. Electrical Appliance for Elevators. James H. Roberts, Grand Rapids, Mich. Filed Feb. 23, 1895.

537,857. Electric Motor Car. William Robinson, Boston, Mass. Original application filed April 12, 1889. Divided and this application filed Jan. 16, 1890.

537,860. Electric Guest-Call. Frank O. Smith, La Crosse, Wis. Filed June 2, 1894.

537,876. Rheostat. George H. Whittingham, Baltimore, Md. Filed Dec. 11, 1893. Renewed Sept. 27, 1894.

537,907. Rosette, or Ceiling Cut-Out. Eugene A. Snow, Syracuse, N. Y., assignor to John R. Owen, same place. Filed Sept. 21, 1894.

537,920. Coupling for Electrical Connections. James M. Faulkner, Philadelphia, Pa. Filed Aug. 9, 1894.

537,929. Life-Guard for Cars. Henry Mills, Brooklyn, N. Y., assignor to Thomas Adams, Jr., same place. Filed Feb. 13, 1894.

537,932. Method of and Apparatus for Protecting Electric Circuits. John M. Oram, Dallas, Tex. Filed Jan. 15, 1895.

537,967. Telephone System. William Coonan, Jersey City, assignor to himself, and William A. Childs, Englewood, N. J. Filed Aug. 4, 1892.

537,989. Storage Battery. Morris Moskowitz, Newark, N. J., assignor by direct and mesne assignments, to himself, Leon D. Adler, same place, A. S. Adler, Philadelphia, Pa., and Theodore W. Myers, New York, N. Y. Filed May 7, 1897.

537,994. Controlling Mechanism for Electric Motors. Charles H. Richardson, Philadelphia, Pa., assignor to the S. S. White Dental Manufacturing Company, same place. Filed June 9, 1894.

538,005. Electric Railway. Conrad C. G. Wolpers, Brooklyn, N. Y. Filed Oct. 2, 1894.

538,020. Insulated Conductor. William M. Habirshaw, New York, N. Y. Filed Oct. 16, 1894.

538,023. Electric Arc Lamp. Frank M. Lewis, London, England. Filed October 12, 1894. Patented in England Dec. 4, 1893, No. 23,239.

538,024. Electric Brake. Edward D. Lewis, Savona, N. Y. Filed Dec. 7, 1894.

538,090. Electric Cut-Out. Herbert A. Wagner and Ferdinand Schwedtmann, St. Louis, Mo. Filed Jan 5, 1895.

538,097. Commutator Brush. Louis Boudreaux, Paris, France. Filed Oct. 28, 1892. Patented in France July 2, 1892, No. 222,767; in England Oct. 8, 1892, No. 17,982; in Switzerland Oct. 11, 1892, No. 5,689, and in Germany Oct. 12, 1892, No. 68,369.

538,104. Electric Motor for Railway Cars. Charles E. Emery, Brooklyn, N. Y. Filed April 19, 1894.

538,127. Electric Door-Opener. John Schneider, Long Island City, N. Y. Filed May 7, 1894.

538,132. Electrical Igniting Device for Gas Engines. Alfred J. Signor, Elkhart, Ind. Filed March 26, 1894.

538,136. Working of Railway Points and Signals by Electricity. Illius A. Timmis, London, England. Filed June 9, 1894. Patented in England Nov. 11, 1893, No. 21,946.

538,158. Electric Railway System. James M. Faulkner, Philadelphia, Pa. Filed Jan. 12, 1895.

538,179. Car Fender. Thomas O'Brien, Washington, D. C. Filed Jan. 23, 1895.

ELECTRICAL AGE

VOL. XV., No. 19. NEW YORK, MAY 11, 1895. WHOLE No. 417

ESTABLISHED 1883.

Entered at New York P. O. as second-class matter, January 18, 1891.

THE ELECTRICAL AGE PUBLISHING CO., PUBLISHER

TERMS OF SUBSCRIPTION:

One Copy, one year,	$3.00
One Copy, six months,	1.50
Great Britain and other Countries,	4.00

Cable Address (all Cables,) "Electage," New York.

W. T. HUNT, President. F. N. BASSETT, Vice-President.

T. R. TALTAVALL, Secretary and Editor.

NEWTON HARRISON, E. E., Scientific Editor.

Canadian Representative, E. W. SAYER, Montreal, Que.

ADDRESS ALL COMMUNICATIONS TO

THE ELECTRICAL AGE PUBLISHING COMPANY,

FIRST FLOOR, WORLD BUILDING.

NEW YORK.

NEW YORK, MAY 11, 1895.

CONTENTS.

THE UNDERWRITERS' RULES.

The paper of Prof. W. A. Anthony, on the subject of "Underwriters' Rules," read at the last meeting of the American Institute of Electrical Engineers, excited an earnest discussion. On account of the importance of the subject, and the evident desire of many of the members to express their opinion regarding it, the discussion was postponed until the next meeting. We print on another page of this issue a portion of the remarks made by several gentlemen in discussing the subject of the paper. The Board of Underwriters will find it difficult to extricate itself from the tangle it has got into and at the same time do it with dignity.

THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

The executive committee of this association held a meeting in New York on the evening of May 4, and it was officially decided to hold the next convention in New York city. The resolution was passed by a unanimous vote. The question of holding the convention independent of the usual exhibition of manufactures and supplies was considered, but nothing definite was accomplished in this direction at this time. A committee was, however, appointed to consider the subject in all its relations. Vice-President Nichols offered a resolution, which was adopted, thanking the electrical press for its interest and work in behalf of the association.

THE AMERICAN PATENT SYSTEM.

In the May *Forum*, Prof R. H. Thurston makes a strong plea in behalf of protecting the rights of American inventors. The progress of the United States in all the arts and sciences, he asserts, and with truth, has been largely due to the superiority of the American patent system as compared with that of foreign countries. The protection, or the supposed protection which the American patent afforded an inventor was the stimulus and basis for the extraordinary development of inventions in this country. But, Prof. Thurston notes, the spirit of our patent system has been opposed in late years by one diametrically opposite in its nature, and its malevolent influence has been seen and felt in the tone of legislation and in the decisions of the courts. The latest and most severe blow was the decision of the United States Supreme Court in the Bate Refrigerator case. This decision, Prof. Thurston admits, was probably, beyond question, strictly right as an interpretation of the law, but the effect is to deprive inventors in many cases of years of profitable business from his invention. The fault lies with the legislators and not with the courts, the author contends. A portion of Prof. Thurston's article is printed on another page, and it will be found extremely interesting reading.

TELEPHONING BETWEEN SHORE AND LIGHT-SHIPS.

On another page will be found an interesting article on the subject of telephone communication between shore and light-ships at two points along the eastern coast of America. The experiments were conducted under the auspices of the Light-House Board, and, although the available funds for the purpose were extremely meagre, very satisfactory and encouraging results were reached. Considerable experimental work of this character has been done in England and elsewhere across the Atlantic, but we doubt if any better, if as good, results were obtained. Congress has been asked several times in late years to appropriate a definite amount of money to enable the light-house authorities to carry on the proper experimental work in this direction, but in its wisdom it has not yet seen fit to set apart for this purpose a portion of the money it appropriates every year. It is hoped that Congress will soon come to realize the value and importance of this particular work and appropriate funds commensurate with its importance.

BROOKLYN CENTRAL OFFICE, FIRE TELEGRAPH.

FURNISHED BY THE GAMEWELL FIRE ALARM TELEGRAPH COMPANY, 19 BARCLAY STREET, NEW YORK.

The new headquarters, 365 Jay street of the fire alarm system, Brooklyn, N. Y., is one of the most completely equipped and modern in the country. The apparatus and system installed are that of the Gamewell Fire-Alarm Telegraph Co., of New York, whose systems of fire and police telegraphs are extensively used throughout the country. We give herewith four excellent illustrations of the Brooklyn headquarters.

The main switchboard is shown in Fig. 1. It is made in three sections and stands on a marble base. It is arranged for sixty metallic circuits, each circuit including boxes on the street and engine houses.

Each circuit is provided with an annunciator-drop on the switchboard, which drop indicates the number of the line over which a signal is received.

shows the number of the circuit over which an alarm comes, and the same electrical impulses operate the multiple pen register, shown very clearly in Fig. 2. This pen register has 51 recording pens, 50 of which mark in black ink and one in red ink. The red-ink pen is used as a tell-tale and gives a record of any trouble on any one of the circuits.

Each circuit is provided with a relay and a telegraph key, as shown along the central portion of the board, and illustrated in Fig 2. These telegraph instruments are used for communication of a special nature between the street boxes, engine houses and headquarters. Each circuit is also provided with a spring-jack switch for effecting the various changes in connections, and for throwing in an auxiliary battery when necessary. Each circuit is specially protected against abnormal currents by metallic fuses, or by devices which divert such currents to the earth.

Fig. 3 gives a view of the automatic line testing apparatus and transmitter. The office of the latter instrument, which is shown at the extreme left of the illustration, is to transmit or repeat an alarm from any one circuit over the various other circuits. The testing apparatus, shown in the centre of the illustration, is always in circuit and automatically indicates derangement on any of the lines.

Fig. 4 gives a general view of headquarters. At the extreme left is seen the automatic line tester and transmitter. The relay cabinet and switchboard are shown in the central portion of the view, and the main switchboard at the right.

Fig. 5 shows a combination of the Gamewell Company's Excelsior electro-mechanical gong with a visual indicator. This apparatus automatically displays in plain figures the numbers of all boxes from which alarms are sent in, at the same time sounding the box number on the gong. These instruments are said to be very perfect and reliable in operation, and their use entirely obviates the mistakes which sometimes occur through miscounting the strokes on the gong.

Between five and six hundred cities, towns and corpo-

FIG. 1.—MAIN SWITCHBOARD.

A test galvanometer is also provided for each circuit, and is situated on the board immediately below the drop. In the centre of the board are shown two test switches.

On the top of the board is a circular indicator which

rations in the United States use the Gamewell fire-alarm system, and in many of these places the system has been in successful operation for more than a quarter of a century.

OUR DEBT TO INVENTORS.*

BY PROF. R. H. THURSTON.

The telegraph and the telephone, those great "monopolies," so much inveighed against at the moment, have not only presented the world with the grandest illustrations of the helpfulness of modern science in promoting commerce and the industries of production; they promote also, directly and indirectly, and in a thousand ways, the intelligence and culture of the race. Morse and his colleagues among inventors gave the world, as a contribution to education and a stimulus to moral growth, inestimable profit upon all its patrons have paid into the treasury of the telegraph companies—to be redistributed to the world. The telephone, however "business-like" its management, is a gift from the inventor of vastly greater worth to the world than all the dividends ever declared by the telephone companies. Edison, Thomson, and the General Electric and Westinghouse Companies, representing contributions to the world of invention and the mechanic arts, as a limited tribute, have given handsome profits to the world of users of their inventions and products. And yet the world is becoming sadly ungrateful, and the inventor must apparently, hereafter, as some have in fact already done, look elsewhere for reward. A letter under the hand of the writer tells of the inventor's plan to remain in a foreign country, because, as he believes, he is now more likely to be protected in his property, and to gain more from his studies and labor than in his own country, where, as he thinks, public sentiment, the law, and the courts are continually exhibiting less and less disposition to treat their greatest benefactors with fairness and liberality.

For a century our own patent law was steadily perfected, and the wonderful progress of the United States in all the sciences and all the arts has been very largely due to the superiority of the patent system of our country over the contemporary codes of foreign countries and to its admirable adaptation to its purpose. It has always been possible for an American inventor, however poor, to find the means required by him to secure a careful examination of his invention, a report upon its novelty, and, if new and useful, a patent that protects him against infringers and gives him opportunity to perfect the device and to put it into profitable operation, thus insuring a reward in some degree commensurate with its practical value. It is this protection and stimulus that have been the main basis of the extraordinary development of inventors and inventions and of the marvellous advance that the present generation has witnessed.

Except for our hitherto admirable system of patent law, this country, in a word, would not have exhibited to the world that tremendous growth in all the arts, in every industry, in all that makes for civilization, which has been the great social phenomenon of the nineteenth century. In Great Britain, where, until recently, it was required that a man should give what, to the average inventor, is a small fortune, to secure, not protection, but simple registration of the fact of his having made what he supposes to be an original invention; and on the continent of Europe, where the patent laws were and still remain in great degree cumbersome, troublesome and embarrassing as well as costly, no such development of the arts, no such outburst of inventive genius, and no such advancement of the people in all that constitutes wealth and produces comfort have been seen. It has been universally admitted that the United States has owed to the simple and inexpensive and effective action of the patent-law system, as well as to the freedom of its political institutions—the two forming units of a whole—the mighty march of its development and civilization. The blessings of the patent law have been inconceivably great.

But a spirit diametrically opposed to the spirit in which the patent system was conceived and enacted has within a few years sprung up, and its malevolent influence has been promptly seen and felt in the tone of legislation and in the decisions of the courts. The old feeling of indebtedness and of gratitude to the inventor and to the exploiter of inventions has become tempered by criticism and by a cavilling spirit, which seeks to deprive these greatest of benefactors of the race of the intellectual property which they create and the material benefits which they, in com-

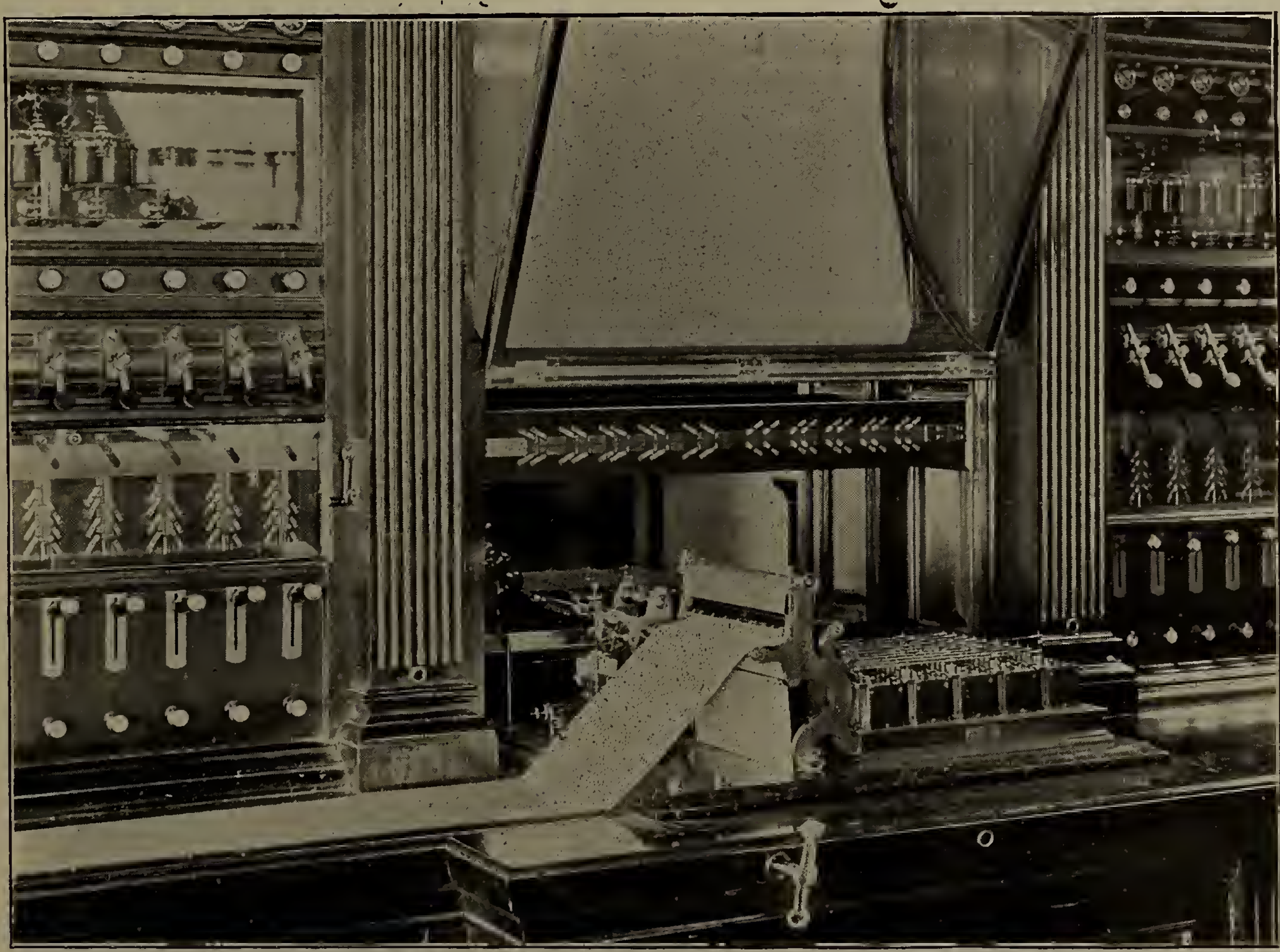


FIG. 2—MULTIPLE PEN REGISTER AND PART OF RELAY CABINET, BROOKLYN FIRE ALARM HEADQUARTERS.

* From *The Forum*, May, 1895.

paratively slight degree, share with the world. In many ways, both legislation and the decision of the courts are curtailing their rights and depriving them of the just share which was formerly cheerfully granted to them, of the gains made by the world through their inventions. The inventive genius and his wholly beneficent work are now too often looked upon with suspicion, jealousy, and a mean opposition which are in strange contrast with the grateful and generous spirit which characterized every legislative and judicial act early in the century, and which pervaded the whole people of the United States from the time of Watt to the time of Corliss, of Fulton, of Stephenson, of Howe, and of Morse. The magnificent results of the work of the inventor and of the patent system now fail of proper appreciation, and the usually comparatively petty returns to the inventor are unreasonably magnified and ungenerously decried by an increasing number of thoughtless or selfish beneficiaries. It is now becoming fashionable to condemn as a monopoly the inventor's temporary possession of his own, under the law; and the greater its value and the larger the advantage to the public the louder becomes the chorus of protest against his receiving his due reward. The killing of the goose that lays secure its introduction and recoup his expenditures, often enormously heavy, in its perfection and introduction. Revised Statute No. 4887, as interpreted by the court of last resort, extinguished, immediately and prospectively, many millions of dollars' worth of inventors' rights, and this must inevitably ultimately result in the repression of the inventive spirit, and must deprive the people of immeasurable benefits which would have come of encouraged and stimulated invention under the older *regime*. The law as it stands, and as it is interpreted, is an insult and a direct injury of enormous magnitude to the best friend of the human race among all its workers—the inventor.

It is easy to see why this is so. The patent law, while assuring a specified period of protection to the inventor and subsequent transfer of his rights and all later profits to the people—who realize all advantages in the end—provides for a system of careful examination of the claims of the proposing patentee. It determines as fully as possible the questions of his priority and of the value of his devices, and settles the question of priority when two inventors claim the same invention. A long time is often required and interference proceedings have often taken months, and even years.

FIG. 3—AUTOMATIC LINE TESTER AND DIAL TRANSMITTER, BROOKLYN FIRE ALARM HEADQUARTERS.

the golden egg is contemplated even by "statesmen" and by the courts with complacency. They would nullify the patent system and put a summary end to this era of progress. They would terminate the period of supremacy of their country in all the industrial arts.

The latest blow, and one of the most severe, which has been aimed at our system of rewards to inventors, was dealt by the Supreme Court of the United States in its recent decision making the domestic patent expire with the termination of any foreign patent on the same device, without regard to the period of life of the former. The decision was, probably beyond question, strictly right as an interpretation of the law. The fault lies with the legislators and not with the court; but the effect is to deprive the American inventor, in many cases, of years of profitable business in the making and using of his device. The period of profitable introduction of a patent is generally late in its life; and, the more important the patent, the longer, as a rule, must the inventor labor before he can

If the inventor, meantime, believes that he can profitably patent his device in foreign countries, and takes out his patent abroad at an early stage in these proceedings, the life of his patent at home is abridged, when it is finally issued, by the full period of the delay in settling his case on the part of the United States authorities. Interferences may even last, or successive declarations of interference may overlap, until his shortest foreign patent has actually expired; in which case his finally declared "rights" have absolutely no existence and no value. In many cases, the inventor may be driven to sacrifice his foreign patents entirely, rather than risk his domestic patent. The outcome of such contingencies is always a damage to the inventor and an unwarranted deprivation of property of his own creation. To base the allowed time of holding proprietorship in such property upon any conditions relating to the time or nature of the foreign patent-claim, is an illogical and grievous injustice.

When the United States loses its regard for the rights

and privileges that were justly and fairly accorded to inventors in our earlier life as a nation, and, instead of gratitude and generous reward, gives them grudgingly less than a fair and liberal share of the profits which they so lavishly secure for the world, a long step will have been taken toward that decadence which historians are accustomed to assure us, inevitably, sooner or later, comes to every people. The immediate and complete repeal of every obstructive law and the inauguration of a new period of good-will and generous encouragement of that highest of industries is the right way and the only way to insure permanence of that growth in material prosperity which has for a hundred years, and until the present moment almost, been the most marked characteristic of our history.

TELEPHONIC COMMUNICATION BETWEEN LIGHT-SHIPS AND SHORE

For two or three years Congress has been asked for an appropriation of $150,000 to provide and maintain communication by telephone, telegraph, or otherwise, with light-ships, light-houses, and life-saving stations on the coast, to secure prompt information of vessels in distress, and to authorize experiments to determine the most effective means for so doing.

Congress, however, has so far failed to appropriate any funds for this specific purpose, yet considerable work has been done in the direction outlined. The Light-House Board has made two experiments of this kind with encouraging results. One was made in 1892 between a relief light-vessel, anchored about a mile from the shore for the special purpose, and a shore station. The method was by setting up electric communication from a wire properly insulated and the moorings of the light-vessel. The communication was perfect while the very frail and cheap plant lasted. The other experiment was made on the Scotland light-vessel off Sandy Hook. A non-continuous cable was used, which was anchored near the light-vessel. An area of some sixteen acres of water was sufficiently surcharged with electricity from the end of this cable to set up telephonic communication from the Scotland light-vessel by means of positive and negative plates on the bow and stern of the light-vessel, which were connected by wires with the telephonic apparatus on board.

The telephone has worked well between the Scotland light-vessel and the shore since early in February, and there has not been, in that time, any break or any interruption.

There is not in use, as yet, any electrical arrangement by means of which either station can call the other, when it is desired to have communication.

The experiments made thus far to make a call-bell work have not been successful, but it is hoped that something of the kind may be put into operation at an early day.

The experiments were conducted on behalf of the government by Prof. Lucien I. Blake, the electrical expert. In 1893 he conducted electrical experiments at Wood's Holl. He connected the electric cable to the anchor, thus utilizing the anchor and its chain as part of the system. But the salt water, itself a good conductor of electricity, absorbed much of the current going into the chain, and for every one hundred volts he lost about seventy-five on the chain. This method, therefore, while satisfactory in some respects, was inadequate and unreliable. Although communication could be had from the ship to the shore, those on the light-ship could hear only very imperfectly, and sometimes not at all, the messages of those at the shore station. To remedy this difficulty a hole was drilled in the mushroom fluke of the anchor, through which the cable was passed, to a copper plug in the stop of the anchor. This made the connection with the chain a close one, and enough current passed through the chain to operate the telephone.

Several government officials then went to Wood's Holl to watch the operation of the system in person. Captain Mahan, the engineering secretary of the light-house board, was present at the trial, and gave the telephone different tests, all of which were entirely satisfactory.

It can thus be said that this first practical experiment in the matter by Professor Blake was a success, and in the report which was made the board considered that the possibility of communicating in this manner had been fully

FIG. 4—GENERAL VIEW OF FIRE ALARM HEADQUARTERS, BROOKLYN, N. Y.

demonstrated. Unfortunately the gale of August 21, of that year, during which the light-ship dragged from her moorings, broke up and displaced the experimental plant.

Last year, at the request of the government, Prof. Blake went to New York to put the system into practical operation between the Sandy Hook light station and the Scotland light-ship. Here, however, the electrical conditions were found to be entirely different from those at Wood's Holl, as the depth and density of the water were much greater. Instead of one mile from shore, as was the case at Wood's Holl, the Scotland light-ship was four miles distant, and instead of a depth of thirty feet of water they had here seventy feet. In addition to these different conditions, Prof. Blake was obliged to use an old electric cable,

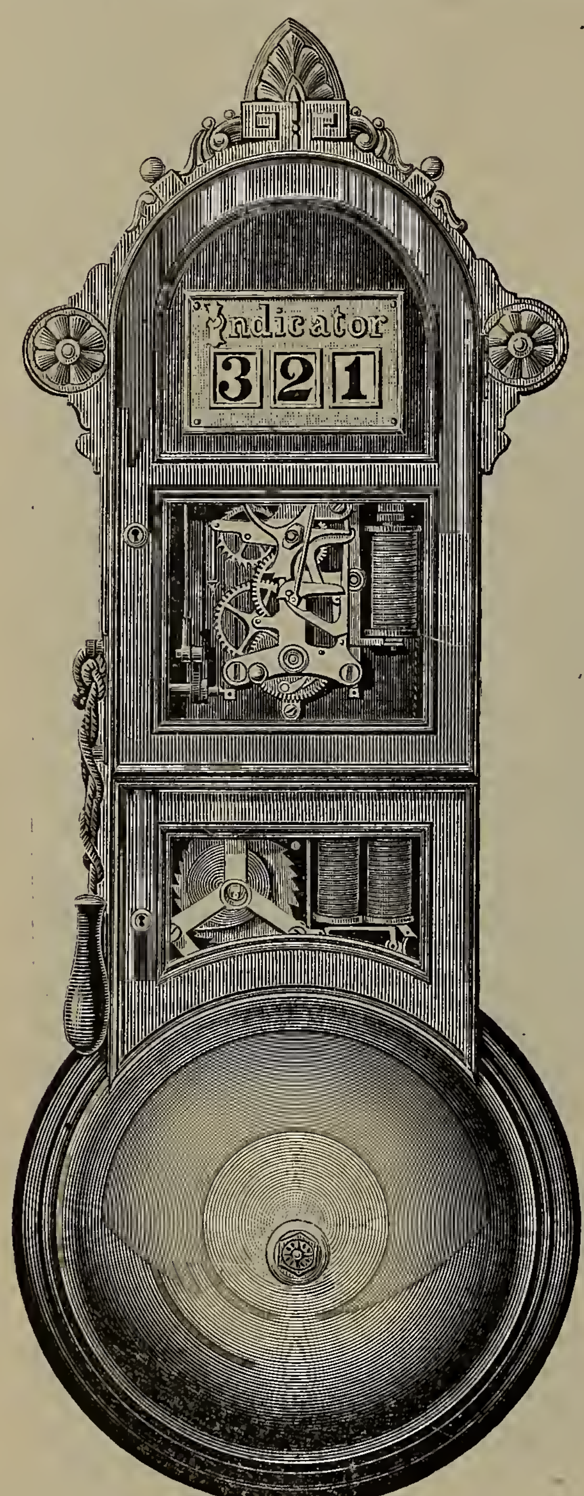


FIG. 5—GAMEWELL GONG AND VISUAL INDICATOR.

the only one to be had. This cable was larger than that in use at Wood's Holl, being one inch in diameter of sixteen gauge copper wire. It was insulated with jute and gutta-percha and was covered with an armor of heavy iron wire. Probably because the cable was old and inefficient, the first experiment at the Scotland light-ship was not a success. It was thought that the iron armor of the cable had become magnetized and the electric current by induction was travelling backward and forward on the iron armor. The experts succeeded in receiving communications one way but not the other. Prof. Blake found that the plant was not large enough for the work and that it would be necessary to use a new cable without armor. Instead of the telephone cable passing through the mushroom fluke of the light-ship anchor, and communicating as in the other case, through the anchor chain with the vessel, the cable is now run to a spot near the light-ship's anchor, within the field of the ship's circular swinging of the wind and tide, which field, a portion of the ocean itself, is electrified. This plan was successful from the first, but to equalize the electricity over this field another and smaller cable was attached to the end of the first cable and ran at right angles to it in both directions. From this new cable again other still smaller cables were run parallel to the first. In this way the field through which the light-ship moves in her movements around her anchor is thoroughly and equally electrified. So strong, indeed, is this electric current, and so efficient is the salt water of the ocean as its conductor, that persons on board the light-house tender can, by trailing the positive and negative plates of their telephone in the water over the place where this cable leading to the shore is laid, communicate with perfect ease with persons on the light-ship, as well as with those on shore, and can receive equally well messages from them. This field is about 600 feet wide and extends for four miles, the entire distance from Scotland light-ship to the shore.

The work done in this matter was with funds squeezed from the general appropriation for the maintenance of light-ships, and which were spared with difficulty. The completion of the experiments will depend upon the Board's ability to provide the funds and the labor necessary for the purpose. The working plans can be carried into effect when men and money can be spared for the purpose.

Although the repeated failures of Congress to appropriate the money asked for with which to carry on these experiments tends to discourage the enterprise, the Light-House Board has lost none of its desire to carry out its plans. It is suggested that if the marine public would take the proper interest in the matter and get their representatives in Congress interested also, the purpose of the Board could be carried to its fruition.

ELECTRIC LIGHT PLANT AT THE ROYAL VICTORIA HOSPITAL, MONTREAL.

BY E. W. SAYER.

A description of the electric light plant of this institution, which is one of the finest on the continent, may prove of interest to the readers of the Electrical Age.

The architects of the building were Saxon, Snell & Co., of London, Eng., the resident architect being J. H. Rhind, of Montreal.

The wiring throughout is on the three-wire system, with a large neutral wire to admit of running motors, etc , on the two-wire system, when necessary. The wires are all encased in interior conduits, in order to insure the utmost safety. The wiring was contracted for by the Royal Electric Company, and installed under the supervision of Mr. Lewis Burran. Before the work was completed Mr. Burran resigned, and it was taken up and finished by Mr. W. B. Shaw, now electrician of the Montreal Electric Company. The wiring was well done, and is giving good satisfaction.

The switchboard was made and installed by the Canadian General Electric Company, whose works are at Peterboro, Ont. It is a fine piece of work, with polished brass jack-knife switches, and finished in polished black slate, with a heavy ornamental black walnut border. The board is so arranged that errors in throwing switches on or off are avoided.

The dynamos are direct-connected to the engines, there being three sets, each of about 250-light capacity. One is reserved as a spare set, the other two being used on the three or two-wire systems as desired.

The accumulator plant consists of sixty Crompton-Howell cells, charged through a "booster." This feature of the plant was especially described and illustrated in the Electrical Age of April 20, last.

The main switchboard is equipped with Weston instruments, and an Aron electricity motor, and an automatic cut-in and cut-out, of English make, are used on the accumulator board.

The direct-connected cells were furnished by W. H. Allen & Co., of England.

A finer plant than this one would be hard to find, and it reflects great credit upon the ability of Messrs. F. H. Badger and F. Redpath, the advising electricians.

PRINCIPLES OF DYNAMO DESIGN.

BY

Newton Harrison, E.E.

(*Continued from Page 155.*)

The general design of an armature or in fact of any mass of iron laminated and revolving in a magnetic field should have as its first object the reduction of these local and objectionable qualities just spoken of. There is naturally a somewhat different view taken of a transformer with a constantly varying magneto-motive force and its consequent changes.

But these things in themselves are treated in a more special manner and need therefore a substantially different foundation upon which to heap a superstructive of intrinsic value.

As regards the true meaning of the relation existing between the loop and the consumed energy, the words of Steinmetz apply with full force in this wise: "The area of the looped curve of hysteresis represents the energy dissipated by molecular magnetic friction then, and only then, when during the magnetic cycle neither energy is exerted upon the magnetic circuit by another source of energy, nor work done by or in the magnetic circuit."

In his denotations he remarks about the hardly recognizable difference between "cast iron" "steel" and wrought iron" either mechanically or magnetically.

Many kinds of steel vary but slightly from wrought iron; they merge so thoroughly into each other that the difference is not even characteristic of strong distinctive qualities. With this brief resume of the ground so recently covered, the truisms of design might seem more apparent. For armature cores the softest and most highly permeable grade of wrought iron is that possessed of the least hysteretic qualities and, when exposed to the stresses and strains of a magnetic field, would develop a minimum of heat as *waste energy*.

This loss should never be of an appalling nature. It might be completely removed from practical consideration in comparison with other losses derived from poor qualities of oil, belt slipping, tight bearings or badly fitting brushes. So that, though its importance as a scientific fact and as an element in design with serious consideration can not be doubted, its effect upon the output of the machine would be but slight unless the most general rules were totally disregarded.

Yet by observing the old adage that every little helps, the temptation to only casually consider what appears to be but a trifling source of loss is avoided and the conscience of the designer set at rest. Rough calculations always contain an element of doubt and lead to further carelessness, that entails a loss of money as well as time.

To produce a table showing the exact value of the hysteresis for different speeds would be of importance, especially if the specific induction also varied.

It seems as though the difference between cast iron, steel and wrought iron was so slight that it is almost impossible at times to descriminate between them. From a standpoint that treats of their magnetic qualities solely; the range of permeabilities observed would simply be an indication of the purity of the iron more than anything else. It is so well known that wrought iron is the nearest approach to perfect iron that it seems almost unnecessary to repeat the fact, but when we consider that the grainy structure so characteristic of it is more properly due to the process employed than to the quantity of carbon contained, it seems highly possible that iron subjected to other processes might contain the same minimum of carbon and foreign materials, and yet give people the idea that it is totally different in composition and structure.

Mild steel seems to occupy this position. Its structure is not of a stringy nature, but take a sample that has been rolled or drawn into wire and a fibrous texture immediately appears. While mitis metal is practically wrought iron of a homogeneous nature; magnetically its duplicate, but mechanically its opposite. Again many qualities of cast steel would fill in the list between cast iron and steels so that it is a matter so strongly dependent upon the degree to which the process is carried out, that the difference if any, between cast iron, steel and wrought iron, disappears upon close examination.

The real fact of the matter is simply this: that iron alloyed with anything else quickly loses its magnetic qualities and in a degree proportional to the amount of alloyed material. Thus it seems that carbon has a most detrimental effect upon iron in general, so that the percentage contained is, as it were, an index of the magnetic inefficiency, caused directly by its presence. While this fact is prosaic it is none the less wonderful, for it may by close investigation lead to a better understanding of the nature of the relationship between magnetizable bodies and their alloys.

There is no necessity for a deeper insight into this question of metals for dynamo frames than such as would lead to practical issues. Coercive force and permeability seem at times to occupy the same position when considerations governing the choice of metals are being discussed. But this difference always exists; that one is the cause and the other the derived effect.

(*To be Continued.*)

Table of Hysteresis Loss Based Upon Steinmetz's Formula: $W = \eta N 10^{-7} \left(\frac{L_1 - L_2}{2}\right)^{1.6}$

Specific Induction. Per sq. inch.	Specific Induction. Per sq. cm.	Iron of Armature Core, .0035 Inch.	Watts Dissipated. At 1000 revs. per minute. Per cu. in.	Per cu. cm.	Watts Dissipated. At 1500 revs. per minute. Per cu. in.	Per cu. cm.	Watts Dissipated. At 2000 revs. per minute. Per cu. in.	Per cu. cm.
62500	10,000		.2250	.0146	.3375	.0219	.4500	.0292
68750	11,000		.2625	.0169	.3937	.0254	.5250	.0338
75000	12,000		.3000	.0196	.4500	.0294	.6000	.0392
81250	13,000		.3500	.0223	.5250	.0335	.7000	.0446
87500	14,000		.3875	.0251	.5812	.0376	.7750	.0502
93750	15,000		.4375	.0280	.6562	.0420	.8750	.0560
100000	16,000		.4875	.0311	.7312	.0466	.9750	.0622

THE WADDELL-ENTZ CO.S AFFAIRS.

Messrs. Joseph L Colby, George Hunter Brown, Jr., Wm S. Hall, and Antonio Knauth, constituting the committee of stockholders and creditors of the Waddell-Entz Company, announce the failure of their efforts to bring about a reorganization of the affairs of the company. The court in Bridgeport, Conn., has ordered a foreclosure of the property with certain assets of the company. The sale will take place some time in May.

UNDERWRITERS' RULES.

In the discussion that followed the reading of Prof. W. A. Anthony's paper on "Underwriters' Rules," before the American Institute of Electrical Engineers on April 17, last, strong expressions of opinion were developed.

Mr. C. O. Mailloux:—This paper, with its unimposing title and modest dimensions, is, I think, one of the greatest importance to electrical engineers. I think that we should be very watchful of the construction which is placed upon the rules formulated by the different insurance companies. They may be working for the purpose of making the electrical business better, but that is with them only an incidental consideration; they have not the interest in so doing that we should have. Their interest is primarily to see to it that the installation is made safe from fire. We have a further interest. We have some interest in seeing that the installation is perfect, not only electrically, but practically, and that it is a credit to the profession which it represents. I am very sorry to call the attention of this body (or at least some of the members of it who may not be familiar with it), to the fact, though many of you are familiar with it, that in the matter of insurance rules the electrical fraternity has been handled with a spirit of inconsistency and partiality, and with a want of that broad, liberal treatment that characterizes other lines of fire inspection. This case, of the Attix wire, is perhaps as good an instance as any, and it ought to be one sufficient in importance to call the attention of electrical engineers to the necessity of our acting, either singly or jointly, in such a manner and with sufficient emphasis, as to let our voice be heard, and prevent the continuance of such inconsistencies.

As the paper very clearly puts it, it strikes one as almost absurd to characterize or define as a *tube* a piece of wire which has a solid wrapping of some material supposedly fire-proof, applied to it. It is no more a tube than would be any other wire on which might be put a covering braid or some other material than the insulation. I do not see why a simple braid, or a simple tape, really is not as much a tube; yet we have found ourselves tied hand and foot in many cases by such rulings as that on the part of insurance inspection authorities. I might mention a dozen cases in my own practice which are equally incongruous, equally absurd, and which have caused needless delay, needless expense, trouble and annoyance. I think it is time that the Institute, as a body, should protest against a continuance of such rules and such measures on the part of insurance companies. I may state with pleasure that I have heard several representatives of distinguished and prominent insurance companies express themselves in no uncertain terms in regard to the manner in which this work has been done by those who were supposed to represent them and do their best for their business. I have stated to some of them that it has an evil influence on their business. I know of cases where the insured have preferred to do his own insuring rather than submit to the arbitrary dictation of the insurance inspectors. Some of the insurance companies themselves have expressed their dissatisfaction; and they feel, in some quarters at least, that there ought to be a change in policy; that insurance rules ought to be compatible with, and favorable to, progress in electrical installations, and ought to be means of progress rather than obstructing it.

Mr. William J. Hammer:—I am heartily in sympathy with the gentleman who presented this paper and the gentleman who has just spoken. I think severe criticism can be made justly upon the underwriters for allowing their inspectors or their experts to bring out rules of this character and pass them and foist them upon electrical engineers and the public at large. I think many of these things have not been treated in as conservative a manner as they might have been. Last year a very earnest effort was made to secure the co-operation of all the electrical interests, including the insurance inspectors, etc., with a view to having one single set of rules go out, having them more rigidly enforced, and having them kept up to date—those efforts, although very earnest, were not brought to a conclusion. Since that time the committee has continued its efforts, and before very long, the committee of the National Electric Light Association, who are recognized as the ones who have brought this subject to the front for years past, will extend a formal invitation to the representatives of the telephone interests, the street railway interests, the Fire Chiefs' Association, the American Institute of Electrical Engineers and perhaps some other association or two which will be interested in seeing that proper rules which are conservative in their character, and which do not benefit any particular class of manufacturers or any particular industries to the exclusion of others, are adopted; and it is hoped that before this year is out some uniform action will be taken by these organizations which will look to just the step that Prof. Anthony and others have recommended and which is certainly highly advisable. I merely refer to this now, because very earnest efforts have been made during the past year and they are being pushed very actively by a committee of the National Electric Light Association acting in conjunction with some of these other gentlemen, and the matter will be brought before the Institute as well as these other bodies within a short time and in a manner which I trust will appeal to them and be treated as being of such decided importance to the electrical interests for the Institute of Electrical Engineers as well as other bodies to co-operate with the National Electric Light Association in its important work.

Mr. H. Ward Leonard:—This subject is one that has interested me for a good many years and I am familiar with the difficulties that have always been met with by contractors in dealing with the rules set forth by the underwriters and the requirements that they lay down. Having installed a good many hundred thousand lamps on different styles of wiring in the past ten or twelve years, I feel that the use of anything such as has been described in this paper as the Attix "tube and wire" is certainly a distinct reversion to the condition that applied to electric light wiring in about 1885 or 1886. I personally installed work at that time which was done with practically identical materials, and which I think were as good as the Attix tube and wire can be today, and it seems to me that the conduit is an essential condition for thoroughly first-class work today, and that a conduit to be of any service whatever must be a permanent, reliable, strong hole which will be always there, enabling you to pull the wire out and in, in case of any failure of the wire. I personally am very strongly a believer and always have been, at least for a great many years, in placing the opposite poles of a circuit, whether it be a two-wire circuit or a three-wire circuit all inside of a single iron pipe, and I have put in some thousands of lamps in this city in which both poles of the circuit are inside the single plain iron pipe, with quite satisfactory results; and I wish to call attention to a point which may not have impressed itself on all the members, and that is, that in case you do have both poles of the circuit inside of the iron pipe and the system of iron pipe be grounded, it is almost inconceivable that any condition of leakage or trouble in the electric circuit should occasion a fire. In other words, it is my belief that the rules of the underwriters which they have so strenuously urged for the last few years, that when conduits are used that only one wire be placed in each conduit, is merely aggravating the possibilities of fires which could be eliminated by using first-class insulated wires, inside of a single metallic conduit. The underwriters apparently have been convinced of this point comparatively recently and have waived that requirement where the wires are placed in an armored conduit. As an indication of the difficulty of securing attention on the part of the underwriters to those whose voices ought to be heard in practical matters relating to electric work, I will say that there exists in this city an association of nearly all of the representative concerns of electrical contractors, and feeling that the underwriters had imposed very arduous and unreasonable rules and in fact conditions which made it more expensive, more difficult and more dangerous to do electric wiring work, the contractors in question appointed a committee when they learned that the underwriters were likely to

issue a new set of rules in the then immediate future. They apppointed this committee to wait upon the underwriters for the purpose of aiding them in drawing the rules and in arriving at rules which would be mutually satisfactory, and I happened to be chairman of that committee and so can speak about it from my own knowledge. A letter was sent to the underwriters, by me as chairman of this committee, expressing a desire to participate in their discussions in regard to this matter, or at least to be given an audience to express our views in regard to some of the points which we hoped would not be inserted in the new rules and which we had considered arduous in the old rules, and the letter was acknowledged with the statement that in case they cared to have any conference with us or to hear any expression of opinion from us, they would let us hear from them, which we never did. I am heartily in sympathy with the general tenor and purpose of this paper and believe that this INSTITUTE is by all means a proper body to express its opinion in regard to matters having so practical a bearing on the work of electrical engineers.

MR. FRANKLIN S. HOLMES :—I am in hearty sympathy with the paper, and am also disposed to criticise the position occupied by the Board of Fire Underwriters.

I understand the board to be an organization of business men, formed to protect its business interests, by issuing and enforcing such rules as will reduce fire risk. Its field is commercial, not technical, and when it deals with technical matters it is liable to act foolishly. As an instance in point, compare the three tables, showing the safe carrying capacity of copper wire, which have been published by it within two or three years. We find that the carrying capacity of a given wire varies nearly 100 per cent. in these different tables. See also the unreasonableness of the board's rulings in the matter of pipe conduits. It prescribes that iron pipe carrying duplex conductors must be linen. And yet if we ground or short-circuit a service, carried in a plain iron pipe, and protected by a twenty-five ampere fuse, by no possibility can we heat the pipe dangerously hot at any point in its length. The lining of the pipe, for small conductors at least, does not affect the fire risk one way or the other, and therefore the board should make no such sweeping rules on the matter. Similarly, in this question concerning Attix wire, its ruling is partial. Any continuous duct into which wires are, or may be, drawn after a building is completed, whether it be paper tube, brass-covered conduit, canvas jacket, or iron conduit, are each and all better than plain wire protected however thickly, by a previous insulation. The insulation of the Attix wire is previous, and in no sense can such protection be considered as the equivalent of a duct, however fragile or strong. I repeat I think the Board of Fire Underwriters has limited duty to perform, and should confine its action to impartial rules in matters involving fire risk only. It should leave devices and methods which pertain to excellence of construction to others whose business it is.

I am very glad to hear that there is a movement on foot which will effect a conference of all parties interested in raising the standard of electric light installations. I hope the result will be, first, a more rational set of general rules, and second, a strict definition of the functions of the Board of Fire Underwriters with reference thereto.

MR. JAMES HAMBLET :—It came to my notice a short time ago that certain buildings in the city of Brooklyn were wired for electric lights, and inspected by the inspectors of the Board of Fire Underwriters, and approved. The lights were used for a time, and then, a certain time after that inspection, they were again inspected and condemned, and the owners were compelled to rewire their buildings or improve them according to the new rules adopted by the same Board of Fire Underwriters. I also know a similar instance in Brooklyn where a contractor made an estimate for the work, and the inspectors were watching him, and the inspector told him that by the new rules a certain new kind of tube was to be used, and he must put in that kind of tube. That destroyed his profits on that little job.

MR. W. J. JENKS :—I feel a great deal of interest in this paper which Prof. Anthony has read, not alone because I am thoroughly in sympathy with the views which he expresses, but also because I think the discussion of the general subject of the relations between the electrical engineering profession and the fire insurance underwriters may, if now taken up by the Institute, become very profitable. I have had some little experience in representing the incandescent electric lighting industry in discussions with the insurance people during the past twelve years. In 1883 representatives of the underwriters came to study the arrangement and operation of the first three-wire underground system in the world, at Brockton, Mass., of which I then had charge. In 1884 the first schedule of insurance rules adapted to the necessities of incandescent electric light construction of central station systems and isolated plants, was issued by the New England Insurance Exchange, as the result of a careful study of actual conditions by Capt. William Brophy, who was then their inspector, and Mr. S. E. Barton, who was then chairman of their electric light committee. In formulating these rules the New England people followed the example which had been set for them in 1881 by Mr. W. H. Anderson and his associates in New York, in their issue of the first rules adapted to series systems of arc lighting, in that they sought information of those who engaged in the practical work of installing electric lamps, and encouraged suggestions from such people as to revisions which the rules might require. This policy of mutual consultation and co-operation was explicitly adopted by Mr. Edward Atkinson in 1882 when he was president of the Boston Manufacturers' Mutual Fire Insurance Co. Co-operative efforts of this sort have been the rule during all the subsequent history of the art, and in proportion to the cordiality of the relations between the insurance companies and the electric lighting and power people, has been the correctness of the form into which insurance opinions have been moulded. There are a great many examples in the rules of the truth of this statement, and while I fully appreciate the differences which now exist as set forth in Prof. Anthony's paper, I think the instances thus afforded and the remarks which have been made to-night, should be considered as local rather than as general in their application. The cordiality which has, as a rule, existed for many years, was well illustrated when in August, 1890 at Cape May, two or three days in advance of the meeting of the National Electric Light Association, a committee from that association met representatives from some of the individual electric light companies and a number of executive men representing the Underwriters' boards of different parts of the country, and chose a sub-committee to collate all the available information as to requirements of the Underwriters throughout the United States and formulate a revised code. I happened to be one of the members of that sub-committee, and the results of our work appeared in the arrangement of what is now the National Code, first adopted by the Western Union Fire Underwriters' Association, then by the National Electric Light Association, and finally (with some modifications) pretty generally by the different boards of underwriters throughout the United States. I believe this code did not appeal to the necessities of the New York Board of Fire Underwriters, or perhaps it might be more correct to say that it is the record of the growth of the business, that the New York Board has desired to have rules which were unique, differing essentially from those which other people were satisfied with. There are several evidences of the correctness of such a theory in the rulings which have from time to time vexed the souls of electrical engineers who have been unfortunate enough to find themselves under the surveillance of some of the inspectors in the Metropolitan district. Other members of the Institute can, and I have no doubt will, give detailed testimony upon these points. But I believe it will be found that looking the country over, the insurance people are disposed to maintain a feeling of hearty accord with all electrical engineers who are worthy of the name, and in addition to this, to boil down their rules so that they will come to be short schedules of methods which are dangerous and therefore are prohibited, rather than manuals of instruction for the guidance of con-

structors who know a great deal more about the business than the underwriters ever expect to learn. I remember that as early as 1877 Mr. Barton, to whom I have just referred, who was at that time more intelligently informed in these matters than almost any other active insurance man in the country, by reason of his close contact with electrical central station men, said in an official report.

"Were we again to begin at the beginning, with our " present knowledge, we think we would be inclined, in " justice to all concerned, to issue rules setting forth those " practices that we would *not* permit, rather than stating " in such complete detail what should be done."

My own feeling has been for several years that the underwriters would ultimately come to the point of issuing a list of commandments as to what the electrical constructors should avoid, leaving us to elaborate a set of rules such as have been spoken of tonight, to teach young engineers in detail what they should do in order to secure the best practical results, and I think that list of commandments should begin, as do the most of those delivered to Moses in the olden times.—"Thou shalt not."

THE ELECTRIC MOTOR.

BY PROF. F. B. CROCKER.

The key to the action of the motor, and particularly to the difference between it and the dynamo, is its counter electromotive force. In the case of the dynamo there exists only one E M F, whereas in the motor there must always be two. The difference between the two cases may be expressed very simply in the following way:

One kilowatt dynamo,

$$C = \frac{E}{R}$$

$$10 \text{ amperes} = \frac{100 \text{ volts}}{10 \text{ ohms}}$$

One kilowatt motor,

$$C = \frac{E - e}{R^1}$$

$$10 \text{ amperes} = \frac{100 \text{ volts} - 90 \text{ volts}}{1 \text{ ohm}}$$

C is the current;
E, the direct E M F;
e, the counter E M F;
R, the total resistance of the circuit;
R^1, the resistance of the armature.

The current and direct E M F are the same in two cases, but the resistance is only one-tenth as much in the case of the motor, the difference being replaced by the counter E M F, of 90 volts, which acts like resistance to reduce the current.

The counter E M F of a motor is the necessary result of the rotation of its armature, as may be shown by the following experiment: Let us take two incidental machines, one of them being connected to the electric light circuit, the current from which causes the machine to run as a motor. This machine is belted to the other machine which is thereby driven as a dynamo. Now in both cases we have incidental armatures revolving at equal speed in magnetic fields of practically the same strength. It is obvious, therefore, that nearly the same E M F must be generated in each machine, because in both cases practically the same number of lines of force are cut by an equal number of turns of wire revolving at the same speed. In the case of the dynamo, this E M F produces a current which may be used to feed a certain number of incandescent lamps. In the case of the motor the E M F is opposed or counter to the direct E M F of the electric light circuit, and the current produced is due to the difference between the two, as expressed in the second of the preceding equations.—*Cassier's Magazine.*

CABLE STEAMER'S ROUGH EXPERIENCE.

A Shanghai paper states that the Great Northern Telegraph steamer "Store Nordiske" met with very severe weather when on the way to Possiette Bay. The steamer was only about 50 miles from her destination when she encountered a strong northerly gale of typhoon force, accompanied by driving snow that prevented anything from being seen, and the cold was intense at the time, the thermometer indicating 40° of frost. Everything on deck was a mass of ice and the steering gear was useless. In this helpless condition the steamer fell into the trough of the sea and was in danger of capsizing, and it was only by almost superhuman exertions that she could be kept going. When the gale moderated all hands were employed to clear the vessel of ice, it being estimated that there were 150 tons weight on board, and this arduous work occupied the crew two entire days. Photographs were taken of the "Store Nordiske" when the gale abated, which gave an excellent view of the extraordinary circumstances in which she was placed.

PICKED UP AT SEA.

In January last, just prior to the sailing of the ill-fated "City of Haverhill," the Scott Electrical Mfg. Co., of New York, installed on her a Huntington 5,000 C. P. search and position light. This apparatus was recently picked up by the pilot boat "James Gordon Bennett." It was found attached to the roof of the pilot-house, floating at sea, some 100 miles off Sandy Hook, and is now in the company's office, 126 Liberty street, New York.

PERSONAL.

Mr. J. S. Speer, secretary of the Partridge Carbon Co., Sandusky, Ohio, is in town. This concern sells from 100,000 to 150,000 carbon brushes a month. It makes a specialty of motor brushes, and every electric railway in North America is using this company's goods.

Mr. William Taylor, of the firm of Taylor, Dee & Mack, Chicago, has been appointed to the position of business manager of the *Electrical World*. Mr. Taylor was for seven years connected with the Electrical Supply Co., of Chicago.

FRANKLIN ELECTRIC SOCIETY.

The Franklin Electric Society will hold a meeting at eight P. M., Saturday, May 18, 1895, at the Cafe Logeling, No. 239 East 57th street, New York. Mr. Maxwell M. Mayer will deliver a lecture on "Dynamo Design."

OPENING OF THE BALTIMORE TUNNEL.

The new belt-line tunnel of the Baltimore and Ohio Railroad, in Baltimore, was formally opened for business on May 1. It was intended to have the electrical equipment of the tunnel completed in time for the inaugural train, but the three electric locomotives have not yet arrived from the General Electric Works at Schenectady, N. Y., and coke-burning locomotives will be used to propel the trains for the present. The electric locomotives will probably be ready by June 1.

ELECTRICAL HUMBUGS.—The United States is not the only civilized country that is pestered with electrical quacks; England has its full quota. Humbugs and quacks seem to thrive better there than they do here. One of the latest English developments of this character is the anti-rheumatic Towel and Clothing Co. The anti-rheumatic clothing insures freedom from pain and disease by the action of electricity generated by the friction of the towel upon the body. Why wouldn't the electricity generated by the clothes answer the same purpose?

DRAWBAUGH'S NEW TELEPHONE.

The Hanover, Pa., *Daily Record* of April 29, describes a test in that place of Drawbaugh's telephone, which instrument the paper declares to be "the best 'phone in existence." The test was made by Mr. Thos. O'Neill, manager of the Hanover Telephone Company, in the presence of many citizens. The instrument is the invention of Mr. Daniel Drawbaugh. It was connected with one of the longest lines out of the exchange, and, standing forty-five feet away from the transmitter and talking to it in any ordinary tone of voice, the words were distinctly heard at the other end of the line. So sensitive is the transmitter, according to the account, that it may be entirely covered with a handkerchief and yet the utterances are distinctly heard in the receiver. The ticking of a watch, held three feet away from the transmitter, was heard at the other end of the line.

The transmitter it is said can be used on distances over 2,500 miles, and the effects of induction are entirely eliminated.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

The annual meeting for the election of officers, reception of reports, and transaction of other business of the Institute will be held at 12 West 31st street, New York City, Tuesday evening, May 21, instead of May 14, already announced on the balloting circulars.

At the same meeting the discussion of Professor Anthony's paper will be resumed, and it is expected that a paper will also be presented by Mr. A. D. Adams, of Boston, on "The Most Economical Form for Bipolar Field Magnets."

ELECTRICAL SOCIETY OF CORNELL UNIVERSITY.

The transactions for 1894–1895 of The Electrical Society of Cornell University will be out of the printer's hands about May 15. The book will be handsomely bound in cloth, of 130 pages and liberally illustrated.

The following is a table of the contents :

The price of the volume will be 75 cents.

Telephone Notes.

The Harrison International Telephone Co., of Chicago, proposes to establish a telephone system in Hot Springs, Ark. The same company is making preparations to establish a system in Little Rock, Ark.

The Cordele Telephone Co., Cordele, Ga., having a capital of $10,000, will erect a telephone system in that place, and extend the lines to adjoining towns.

It is proposed to build a telephone system from Easton to Centreville and Chestertown, Md.

W. B. Mullen, Alice, Tex., is interested in the extension of telephone lines to the big ranches in that State.

The Winnsboro-Ridgeway Telephone Co., Winnsboro, S. C., will build its lines between Winnsboro and Ridgeway. W. R. Rabb is president.

The Mason Telephone Co., of Richmond, Va., has secured a contract to establish a telephone exchange in Greenville, Tex. The same company will build an exchange in McKinney, Tex.

The Kanawha Valley Telephone Co., Charleston, W. Va., which was recently organized, will build its first line from St. Albans to Boone Court House, and another to Montgomery, W. Va.

Telephone Patents Issued April 30, 1895.

Telephone Central Office System. Ezra T. Gilliland, Pelham Manor, N. Y. (No. 538,827.)

Magneto Transmitter. Ezra T. Gilliland, Pelham Manor, N. Y. (No. 538,328.)

Magneto Generator. Ezra T. Gilliland, Pelham Manor, N. Y. (No. 538,329.)

Telephone Switch. Albert F. W. Meyer, Blue Island, Ill. (No. 538,454.)

Street Railway Notes.

The Gwynns Falls Railway Co., Baltimore, Md., has been organized to build an electric road in the suburbs of that city, and will, it is stated, use the Boynton bicycle system. Jos. B. Seth, of Baltimore, is one of the incorporators.

The North Hudson County Railway Co., Hoboken, N. J., is asking the right to operate its Washington street line by electricity.

H. L. Canfield, Xenia, O., is interested in a proposed electric road from Springfield, O., to Wilmington, O. Water power is to be used.

Judge John E. Nolan, of Saginaw, Mich., is interested in a proposed street-car line in Flint, Mich.

J. E. Du Bignon and others, of Brunswick, Ga, have applied for a franchise for an electric road in that place.

The Danville Street Car Co., Danville, Va., will extend its line to the suburbs.

New Corporations.

The Belle Vernon Electric Light and Power Company, Harrisburg, Pa. Capital, $1,000.

The Zanesville & Columbus Electric Railway, Columbus, Ohio, by W. J. Dunzweiler, Albert Adams, A. W. Evans, L. W. Doane and A. A. Patterson. Capital stock, $10,000.

The Cleveland, Painesville & Eastern Railroad Co., Columbus, O., by I. N. Topliff, A. Everett, Chas. W. Wasson and others. Capital stock, $20,000.

The Henlopen Electric Light & Railway Company, Lewes, Del., by Dr. Hiram R. Burton, Henry V. Lyons, John Barnes, Chas. C. Stockley, Robert G. Houston, Daniel Burton and John M. Richardson. Capital stock, $250,000.

The Emporia Telephone Co., Emporia, Kansas, by Calvin Hood, L. L. Hallock, S Straus. T. H. Dinsmore, David Stone, D. W. Morris and W. R. Irwin. Capital stock, $8,500.

The American Telephone & Telegraph Co., Louisville,

Ky., by Edward P. Meany, Melville Eggleston, Jas. Clark, Edmund Trabue and William B. Meany. Capital stock, $10,000.

The Mammoth Springs Electric Light & Power Co., Mammoth Springs, Ark., by H. G. King, M. H. Cook. Capital stock, $100,000.

The Mount Vernon & Messenger Co., Mount Vernon, N. Y., by Horace Granfield, C. H. Ostrander, F. T. Davis and others. Capital stock, $40,000.

The Consolidated Electric Light Co., San Francisco, Cal.

Possible Contracts.

There is some talk of establishing a new electric ligh- plant in St. Albans, Vt.

A new electric light plant is to be established in Leland, Ill.

The electric light plant at Atalla, Ala., is to be improved.

The Leavenworth Light & Heating Co., Leavenworth, Kansas, has, it is reported, purchased the Merchants' Electric Light Co. of that place.

An electric light plant is to be established in Stephenville, Texas.

The Cheraw Knitting Mllis, Cheraw, S. C., is in the market for an electric light plant of 100 incandescent lamps capacity.

New York Notes.

OFFICE OF THE ELECTRICAL AGE,
WORLD BUILDING, NEW YORK,
MAY 6, 1895.

At a meeting of the directors of the Columbia Telephone Company, of New York, held May 6, Mr. C. Howard Scrymser was elected president.

The Metropolitan Telegraph and Telephone Company has obtained permission from the Board of Electrical Control to build a subway in Fifth avenue, from 12th to 23d streets.

Mr. A. De Castro, E. E., 136 Liberty street, has just returned from Para, Brazil, where he installed a plant ot 1,000 h. p. on the Fort Wayne System, with a capacity of 10,000 lamps. Mr. De Castro has installed plants in every South American country.

At a special meeting of stockholders on May 1, of the Edison Electric Illuminating Co., of New York, it was decided to issue 100 year gold bonds to an amount not exceeding $15,000,000, bearing interest payable in gold at such rates as the board of directors shall determine as the bonds are issued. The interest will not, however, exceed 5 per cent. per annum, and the company's property and franchises will be mortgaged to secure the payment of the bonds. A portion of the new issue is to be used in retiring existing mortgages. Not more than $1,000.000 of the new bonds can be issued in any one year. W. T. H.

THE VANCE ELECTRIC COMPANY.

The Vance Electric Company, of New York, has been incorporated with A. S. Vance, president and general manager, and J. H Cheever, secretary and treasurer. The company will carry on a business as general electric contractors and engineers, and has its offices in the Electrical Exchange Building, 136 Liberty street, New York.

Mr. Vance will handle all the work that the company secures, and will give it his personal supervision. His experience dates back over a period of eleven years. The first three years he was with the Leonard & Izard Co., Chicago, and for two years afterward was engaged in central station work on his own account.

In 1889 Mr. Vance came East as general manager of the United Edison Mfg. Co., and remained with that concern until it was merged into the Edison General Electric Company. He then took the position of assistant general manager of the lighting and power department of the latter company, holding the same until September, 1891. From that time until September, 1894, he was general superintendent for H. Ward Leonard & Co., and had entire charge of all of their construction work.

Mr. Vance's experience has been in personally supervising all classes of electric insulation work for railways, central stations, isolated plants, and steamboat work for the above-named companies. In the new company he will take up general construction work in buildings and central station lighting, and will give special attention to the lighting of private residences, devoting particular care to decorative work. He will bring out some new features for interior decoration and appliances for lighting private grounds by means of automatic disappearing lamps. He will also give special attention to isolated telephone plants for private buildings, as well as central station work between towns.

Some of the most recent work just completed by Mr. Vance is the signal plant of the Metropolitan Traction Co., on the Columbus avenue road, New York; complete plant for lighting the Canton Court-House; H. L. Terrill, house and grounds, Rumson road, Red Bank, N. J.; J. L McBirney residence, No. 41 West 36th street, New York; six private residences on West 74th street, New York; Zabriskie Memorial Church, Newport, R. I.; residence of Lispenard Stewart, No. 6 Fifth avenue, New York; residence of Mrs. Anson Phelps Stokes, Lenox, Mass.

CAPO-FARAD BATTERY.

Mr. Jas. J. Pearson has established the Capo-Farad Battery and Appliance Works in the Thames building, New York. Mr. Pearson has taken the Capo-Farad battery entirely out of the hands of the Nassau Electrical Company, and will carry on the business under his own individual responsibility.

The Capo-Farad cell is the smallest and most powerful ever made, and is suitable for any purpose whatever. One cell will run an ordinary door bell a year. It is applicable to firing blasts, testing, signaling, illuminating, electrolysis, cautery, etc.

BALL & WOOD ENGINES.

The Ball & Wood Company, the well-known New York engine builders, are busy on many engines destined for western and eastern points. Mr. C. E. Sargent, the company's Chicago representative, has just obtained a contract for several Ball & Wood cross compound engines for the new City Hall, Milwaukee. Engines of the same class are being installed in the Temple of Music, Grace Hotel, Fort Dearborn Building and by Messrs. Morgan & Wright, Chicago.

The Ball & Wood engine recently placed by Mr. Kenyon in the Manhattan Building, St. Paul, Minn., is attracting very favorable attention. This engine is direct-connected to a Western Electric dynamo and does its work very smoothly and noiselessly, and with very close regulation.

In New York the list of recent sales of Ball & Wood engines embraces the equipment of the new St. Luke's Hospital on the heights of Morningside Park; a second engine for the 42d street warehouse of the Manhattan Storage Warehouse Company, several engines for the New York Central Railroad for the new station at Syracuse, these to be connected with the Eddy dynamos.

Messrs. Stoutenburgh & Company, of Newark, are also putting in two of these engines, and the Danbury and Bethel Railroad Company, of Danbury, Conn., is having a second 425-H. P. cross compound built.

PROPOSALS FOR ELECTRIC LIGHTING.

Sealed proposals will be received until 12 o'clock noon May 23, 1895, for the lighting of the streets of the borough of Mechanicsburg, Cumberland county, Pa., by electricity, as follows, to wit:

First. By 30 or more arc lights, 1,600 candle-power, and 10 or more incandescent lights, of 32 candle-power, to burn every night and all night.

Second. By 30 or more arc lights, 1,600 candle-power and 10 or more incandescent lights of 32 candle-power, to burn every night until 12 o'clock.

Both bids to be on a one-year contract, allowing the borough the privilege of renewing contract annually for two years additional.

Bids in all cases to give price per light per year. The lights to be of the most modern and improved construction. The plant to be erected and maintained with duplicate machinery, under the Borough's franchise, for public and commercial light, heat and power, and be of sufficient power to permit the use of additional arc or incandescent lights as may be required by the Borough from time to time at same or less price than that named in the original contract, the poles, wires and lights to be located and erected under the direction of the Borough Council.

Bidders to name place plant is to be located; if not in the borough of Mechanicsburg, where?

The successful bidder will be required to give a satisfactory bond as a guarantee that the plant will be put into operation within six months from date of contract, if one should be made under this proposal, and that the same will be maintained and operated during the full term of the contract.

The borough reserves the right to reject any and all bids. Proposals to be marked "Bids for Electric Lights," and addressed to J. S. Huston,
Chairman Light Committee,
Mechanicsbnrg, Pa.

BIDS INVITED.

The War Department, through the office of Public Buildings and Grounds, is asking for proposals, until May 28, for the quantities of battery supplies, more or less, mentioned below, for the use of the public buildings and grounds in charge of this office during the fiscal year ending June 30, 1896. These supplies are to be delivered at such times as the needs of the service demand, and free of cartage, at any buildings or public reservations within the limits of the city of Washington as may be indicated:

300 gravity coppers, 5x7 and 6x8 inches. These coppers must be made from the best metal; the 5x7-inch to weigh not less than 1½ ounces each; 6x8-inch to weigh not less than 2 ounces each.

100 crowfoot zincs, 5x7 inches, to weigh not less than 1¾ pounds each.

400 crowfoot zincs, 6x8 inches, to weigh not less than 3¼ pounds each. These zincs must be made from carefully selected spelter; if made from scrap metal or dross they will not be accepted.

2,000 pounds bluestone, best quality.

10 pounds sal-ammoniac, best quality.

350 pounds No. 12 K. K. line wire.

100 pounds extra best No. 12 galvanized line wire.

20 pounds No. 16 office wire, Phillips' patent, braided.

24 6-inch battery jars.

6 zincs for Le Clanche battery.

10 pounds Grimshaw ¾-inch splicing compound.

Bids are to be given per separate article, except when by weight, and then to be by single pound.

Prospective bidders may obtain any additional information, together with the necessary specifications and blank forms, by addressing Col. J. M. Wilson, War Department, Washington, D. C.

Trade Notes.

The Ball & Wood Company, engine builders, of New York, represented in Chicago by C. E. Sargent, removed their Chicago offices on May 1 to 404 Fort Dearborn Building, where all communications in future should be addressed, and where Mr. Sargent would be very pleased to see all his acquaintances.

We have received a copy of illustrated catalogue No. 7 just issued by the Manhattan Electrical Supply Company, 32 Cortlandt street, New York. The catalogue is complete, and of unusual excellence in the matter of paper and printing, and the illustrations are fine. This company manufactures and deals in electrical supplies of every description.

WOVEN WIRE BRUSHES.

The Belknap Motor Co., of Portland, Maine, are the patentees and manufacturers of the best woven wire commutator brush on the market.

Electrical and Street Railway Patents.

Issued April 30, 1895.

538,247. Electrical Signaling System. Bradley A. Fiske, U. S. Navy. Filed Dec. 20, 1894.

538,249. Life-Saving Attachment for Street Railway Cars. James P. Fleming, Albany, N. Y., assignor of one-half to Michael F. Smith, same place. Filed Jan. 4, 1894.

538,271. Electrically and Chemically Heated Crucible. Henry G. O'Neil, Boston, Mass., assignor to Edward Jewell, same place, and Charles W. Welch, Stoughton, Mass. Filed Mar. 24, 1894.

538,272. Electrical-Cigar Lighter. Henry G. O'Neill, Boston, Mass.. assignor to himself and Edward Jewell, same place. Filed Aug. 27, 1894.

538,275. Electrical Brake. Carl E. Pearson, St. Louis, Mo., assignor of two-thirds to Ernest G. Bruckman and Samuel E. Bruckman, same place. Filed Apr. 2, 1894.

538,281. Brush-Holder. Edward D. Priest, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Aug. 25, 1892.

538,283. Street-Car Register, Gustavus Rein, St. Louis, Mo., assignor to the St. Louis Register Company, same place. Filed Mar. 17, 1894.

538,284. Thermal Cut-Out Device. Charles A. Rolfe, Chicago, Ill. Filed Feb. 21, 1895.

538,289. Manufacture of Carbon for Electrical Purposes. Charles P. Shrewsbury, London, and John L. Dobell, Modbury, England. Filed Sept. 10, 1894.

538,295. Trolley. Judson D. Swacick, Canton, Ohio. Filed Oct. 29, 1894.

538,325. Means for Ventilating Electric Motors on Cars. James J. Devine, Clifton Heights, Pa. Filed Mar. 14, 1895.

538,327. Telephone Central-Office System. Ezra T. Gilliland, Pelham Manor, N. Y., assignor to the American Bell Telephone Company, Boston, Mass. Filed June 5, 1894.

538,328. Magneto-Transmitter. Ezra T. Gilliland, Pelham Manor, N. Y., assignor to the American Bell Telephone Company, Boston, Mass. Filed June 5, 1894.

538,329. Magneto-Generator. Ezra T. Gilliland, Pelham Manor, N. Y., assignor to the American Bell Telephone Company, Boston, Mass. Filed Nov. 28, 1894.

538,344. Armature for Dynamos and Electric Motors. Harry Penn and Loftus Lowndes, London, England. Filed Aug. 13, 1894.

538,345. Dynamo-Electric Machine or Electric Motor. Edwin H. Porter, Radford, Va. Filed Aug. 11, 1894.

538,351. Electric Engine. Luther M. Sabin, Washington, D. C. Filed Apr. 27, 1894.

538,357. Underground Electric Railway. John F. Smith, New York, N. Y. Filed Aug. 15, 1894.

538,364. Safety Attachment for Street-Cars. Oscar Beck, Newark, N. J. Filed Mar. 16, 1894.

538,373. Conduit System for Electric Railways. Frank H. Homan, Brooklyn, N. Y. Filed Apr. 24, 1894.

538,377. Electric Elevator. Nils O. Lindstrom, Union Course, assignor to A. B. See Manufacturing Co., Brooklyn, N. Y. Filed Feb. 26, 1895.

538,390. Trolley-Breaker. Walter R. Scott, Buffalo, N. Y. Filed Dec. 19, 1894.

538,391. Trolley-Wire Hanger. Walter R. Scott, Buffalo, N. Y. Filed Mar. 5, 1895.

538,408. Electric Transmission Wheel or Trolley. Charles C. Burton, Pittsburgh, Pa., assignor of four-fifths to Curtis G. Hussey and John C. Des Granges, same place, Lewis E. Holden, Beloit, Wis., and George M. Ludlow, Chicago, Ill Filed Aug. 11, 1894.

538,409. Trolley-Wheel. Charles C. Burton, Pittsburgh, Pa., assignor of four-fifths to Curtis G. Hussey, and John C. Des Granges, same place, Lewis E. Holden, Beloit, Wis., and George M. Ludlow, Chicago, Ill. Filed Aug. 24, 1894.

538,423. Electrical Coupling. Morris F. Koenig and Ira Mann, Hazelton, Pa. Filed Oct. 15, 1894.

538,454. Telephone-Switch. Albert F. W. Meyer, Blue Island, Ill. Filed Jan 11, 1895.

538,456. Car-Fender. Charles E. Montell, White Plains, N. Y., assignor to Jesse F. Griffen and George W. Coventry, same place. Filed June 9, 1894.

538,457. Electric Arc Lamp. John A. Mosher, Chicago, Ill. Filed Feb. 9, 1893.

538,460. Diffuser for Electric Fans. Charles W. McKeehan and Frederick B. Miles, Philadelphia, Pa. Filed Jan. 17, 1895.

538,474. Art of and Apparatus for Transmitting Speech. John Absterdam, New York, N. Y., assignor, by mesne assignments of three-fourths to A. Wilford Hall, same place. Filed Feb. 18, 1891.

538,569. Trolley-Pole Restrainer. Frank Wheeler, Meriden, Conn. Filed Feb. 8, 1895.

538,590. Block System and Apparatus on Electric Railways. Eugen Langen, Cologne, Germany. Filed July 16, 1894. Patented in France June 28, 1894, No. 239,654; in Belgium June 29, 1894, No. 110,746; in Switzerland July 2, 1894, No. 8,632; in Turkey Oct. 29, 1894, No. 423, and in Italy Nov. 10, 1894, LXXIII, 306.

538,591. Car-Fender and Trip. Charles Mahon, Washington, D. C. Filed Mar. 11, 1895.

538,610. Overhead-Trolley. Charles W. Hunt, West New Brighton, N. Y. Filed Feb. 4, 1892.

538,617. Commutator-Brush and Means for Adjusting Same. Robert Lundell, Brooklyn, assignor of two-thirds to Edward H. Johnson, New York, N. Y. Filed July 20, 1893.

538,628. Method of Making Electrodes for Secondary Batteries. William L. Silvey, Dayton, Ohio. Filed Jan. 23, 1894.

538,631. Car-Fender or Guard. Edgar Thomas, Pittsburgh, Pa., assignor of one-half to Marion P. Hatch, Buffalo, N. Y. Filed Dec. 5, 1894.

ELECTRICAL AGE

VOL. XV., NO. 20. NEW YORK, MAY 18, 1895. WHOLE NO. 418

ESTABLISHED 1883.

Entered at New York P. O. as second-class matter, January 18, 1891.

THE ELECTRICAL AGE PUBLISHING CO., PUBLISHER

TERMS OF SUBSCRIPTION:

One Copy, one year,	$3.00
One Copy, six months,	1.50
Great Britain and other Countries,	4.00

Cable Address (all Cables,) "Electage," New York.

W. T. HUNT, President. F. N. BASSETT, Vice-President.

T. R. TALTAVALL, Secretary and Editor.

NEWTON HARRISON, E. E., Scientific Editor.

Canadian Representative, E. W. SAYER, Montreal, Que.

ADDRESS ALL COMMUNICATIONS TO

THE ELECTRICAL AGE PUBLISHING COMPANY,

FIRST FLOOR, WORLD BUILDING.

NEW YORK.

NEW YORK, MAY 18, 1895.

CONTENTS.

TELEPHONE ACTIVITY.

It is interesting to note the intense activity all over the country in the establishment of independent telephone exchanges and systems. In the main these enterprises are purely local, but frequently they are of more pretentious character. and assume the proportions of long distance service. The information we publish each week under the head of Telephone Notes reflects the activity in this direction, and shows that there is an immense amount of work being done in this field. The effect of these undertakings is especially noticeable in the rates charged by the old established companies. The rental charges are taking big drops wherever opposition appears, and the day of high telephone rates is past. A notable feature in the situation appears in the report that the Bell Company has bought out an opposition company in a Connecticut town.

THE LIGHT OF THE FUTURE.

When the sun's rays weaken, when the decay of a colossal planet is heralded to us, how shall we prepare for the inevitable darkness or drive away the iciness of interplanetary space? The glow-worm has taught us its lesson; the will-o'-the-wisp is no longer a delusion. With a whip that science alone can control we will lash the ether until it gives to us the quivering light of dawn—the effulgence of the rising sun.

STATUE TO PROF. HELMHOLTZ.

The proposition to erect a statue in Berlin to perpetuate the memory of Prof. Helmholtz should meet with the hearty support of the scientific world, especially the electrical branch. Prof. Helmholtz did as much as any other individual towards the advancement of the electrical science, and no one was held in higher regard among electricians than he. The object is a worthy one, and a statue would be a fitting tribute to the memory of one so noble and so eminent in science.

GOOD WORK.

The Rapid Transit Commission is going ahead with its work in a business-like manner, notwithstanding the opposition interposed from some quarters. Its preparatory work is about completed and its report and plans have been submitted to the City Council for further action. If the aldermen act as promptly as did the Commission, it is probable that actual construction work will be commenced before long. It is noticed that in the refining process the plans have passed through the road has been brought nearer and nearer to the surface. This has been done to meet, as far as possible, the popular objection to going deep underground.

THE LABOR OF ATOMS.

The invention of an instrument for the measurement of hysteresis awakens a lively interest in the minds of those desirous of obtaining quantitative results in this particular line of research. The world is more curious today than ever. It seeks to know what Spencer calls the "unknowable," and nothing approaches more closely to this field of metaphysical speculation than a machine for measuring, what once might have been termed the movement of infinitesimals. The work necessitated by the impinging of minute particles of iron upon each other while reversing their positions is now measured so that we can feel assured beyond doubt of at least an internal condition, if not identifying itself with our primary hypothesis, at least so nearly approximating it in its observed effects that the difference will lead to no expression of doubt in any case worthy of criticism. If a magnetizable body be revolved between the poles of a magnet, and the magnet be suspended so that any inclination is indicated by a pointer, it is possible by merely revolving the body to produce a hysteretic effect which, by its reaction upon the magnet, will cause it to deflect. In this brief description is contained the exceedingly simple principle of Professor Ewing's magnetic tester, described and illustrated on another page.

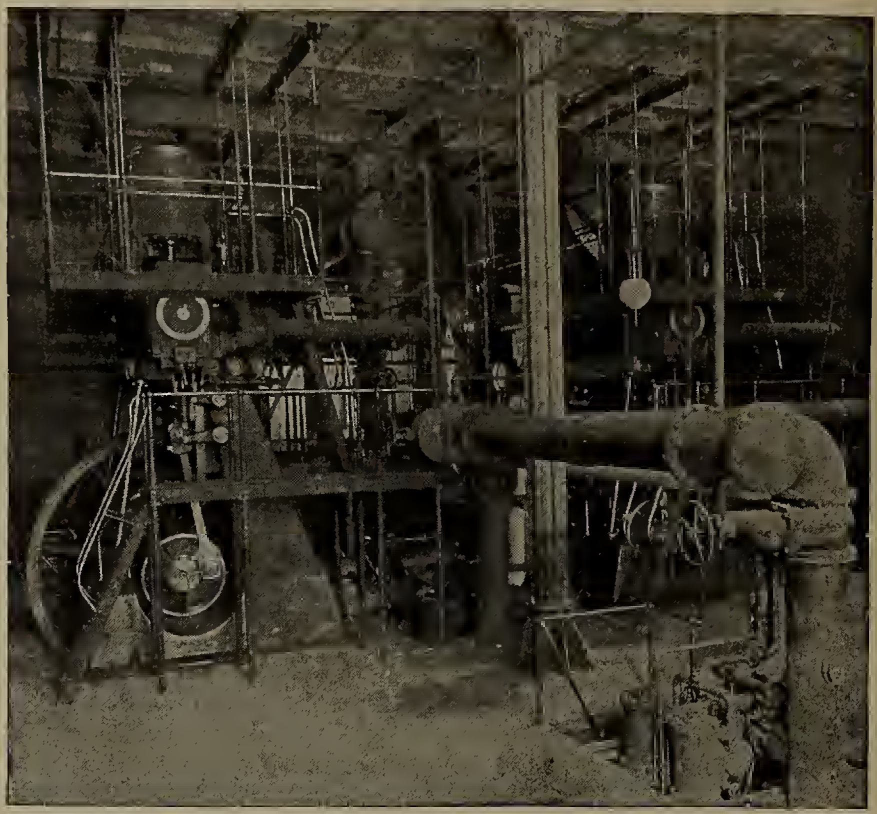
THE NEW STATION OF THE CITIZENS' ELECTRIC ILLUMINATING COMPANY, BROOKLYN, N. Y.

The Citizens' Electric Illuminating Company, of Brooklyn, N. Y., have recently erected an extensive addition to their plant, located at Rockwell place and DeKalb avenue. Some of the features are illustrated herewith.

The addition is a handsome three-story fireproof building, 75x100 feet, thoroughly equipped in accordance with modern engineering practice. The first floor is divided into two rooms, devoted, respectively, to boilers and engines. Two vertical condensing engines have been erected in the engine-room, leaving ample room for four more of the same type. The dimensions of the engines are as follows: Diameter of high-pressure cylinder, 13 inches; of the intermediate cylinder, 21 inches; and each low-pressure cylinder, 23 inches; stroke, 24 inches. The engine will develop, with 155 revolutions per minute and 150 pounds initial pressure condensing, 400 horse-power economically; that is, with the cut-off in the high-pressure cylinder of about four-tenths. The maximum cut-off allowed by the governor gives a large reserve over this.

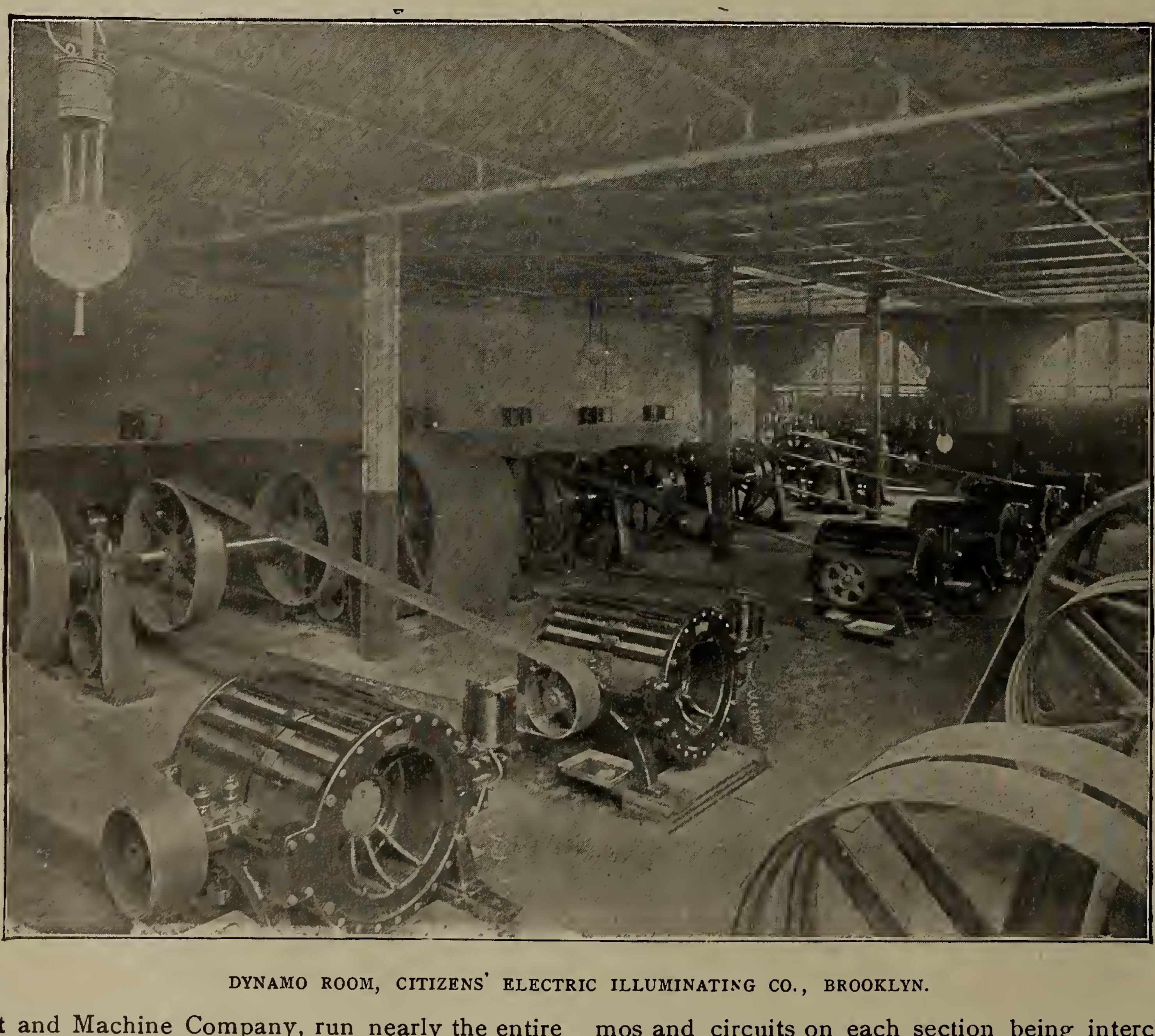
Connected with these engines are two vertical condensers, each having a capacity to condense 25,000 pounds of exhaust steam per hour, when supplied with injection water at a temperature not exceeding 52 degrees Fahrenheit. Water for the condensers is supplied from a system of driven wells having a capacity of 2,000 gallons per minute.

Feed water for the boilers of both the old and new plant is heated by two 2,000 horse-power Goubert heaters. A well-lighted and ventilated dynamo-room occupies the second floor. Two lines of shafting, furnished by the Falls Rivet and Machine Company, run nearly the entire length of this room, to which are belted at present 28 Thomson-Houston arc dynamos with a capacity of 45 lights each. The leather belting for the main driving belts, viz.: two 48-inch three-ply belts, and all of the dynamo belts were manufactured by Chas. A. Schieren & Co., and are of their celebrated electric grade. At one end of this room is a large arc switchboard, extending nearly the whole



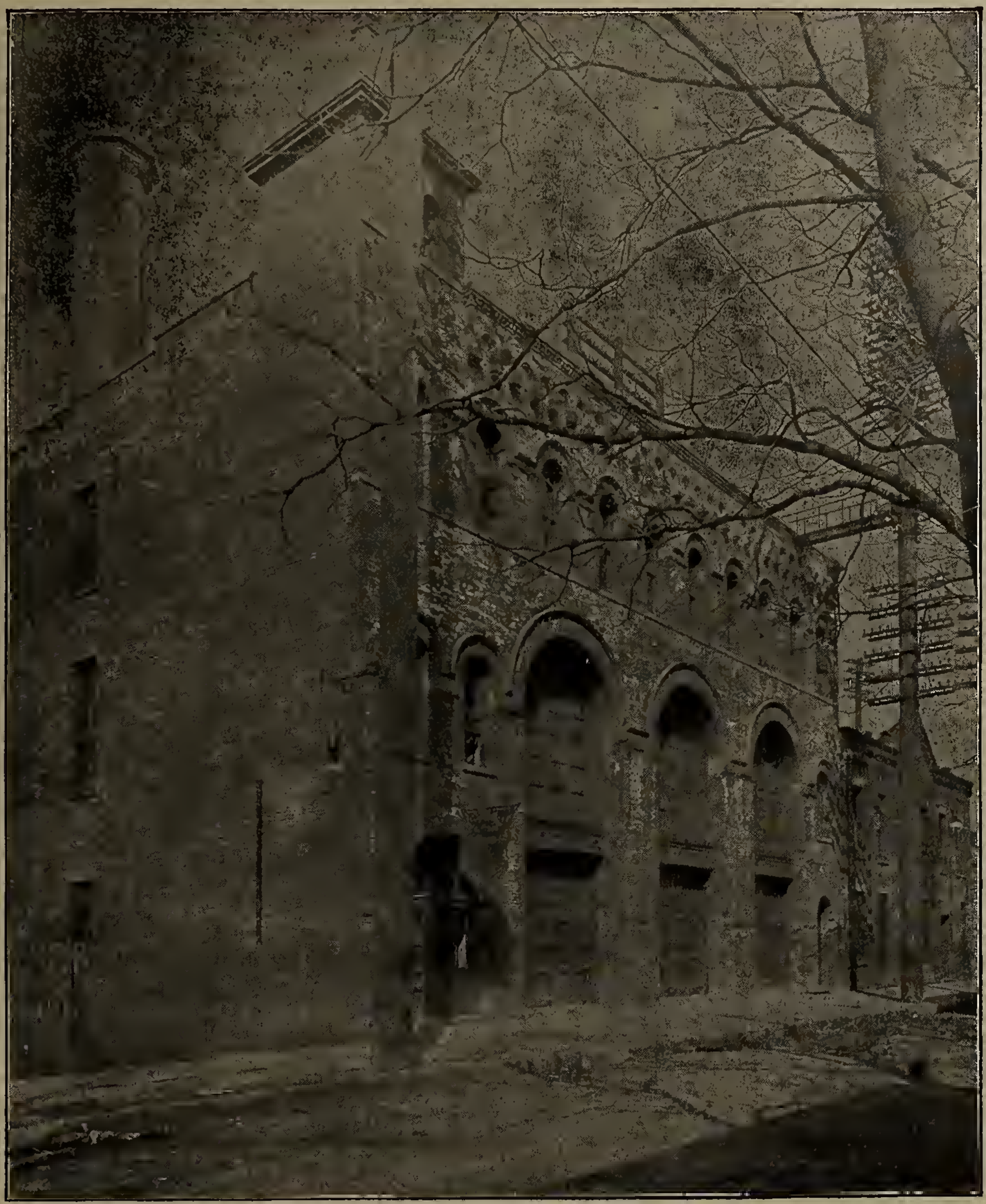
ENGINE ROOM, CITIZENS' ELECTRIC ILLUMINATING PLANT, BROOKLYN.

width of the building. This board handles 96 circuits and 72 dynamos, and is divided into three sections, the dynamos and circuits on each section being interchangeable, and by means of brass "bus" bars, extending the entire length of the board, any circuit may be transferred to either of the other sections. The board is made up of a series of



DYNAMO ROOM, CITIZENS' ELECTRIC ILLUMINATING CO., BROOKLYN.

slate panels seven feet long, six inches wide, and one and one-quarter inches thick, supported by an iron frame at top

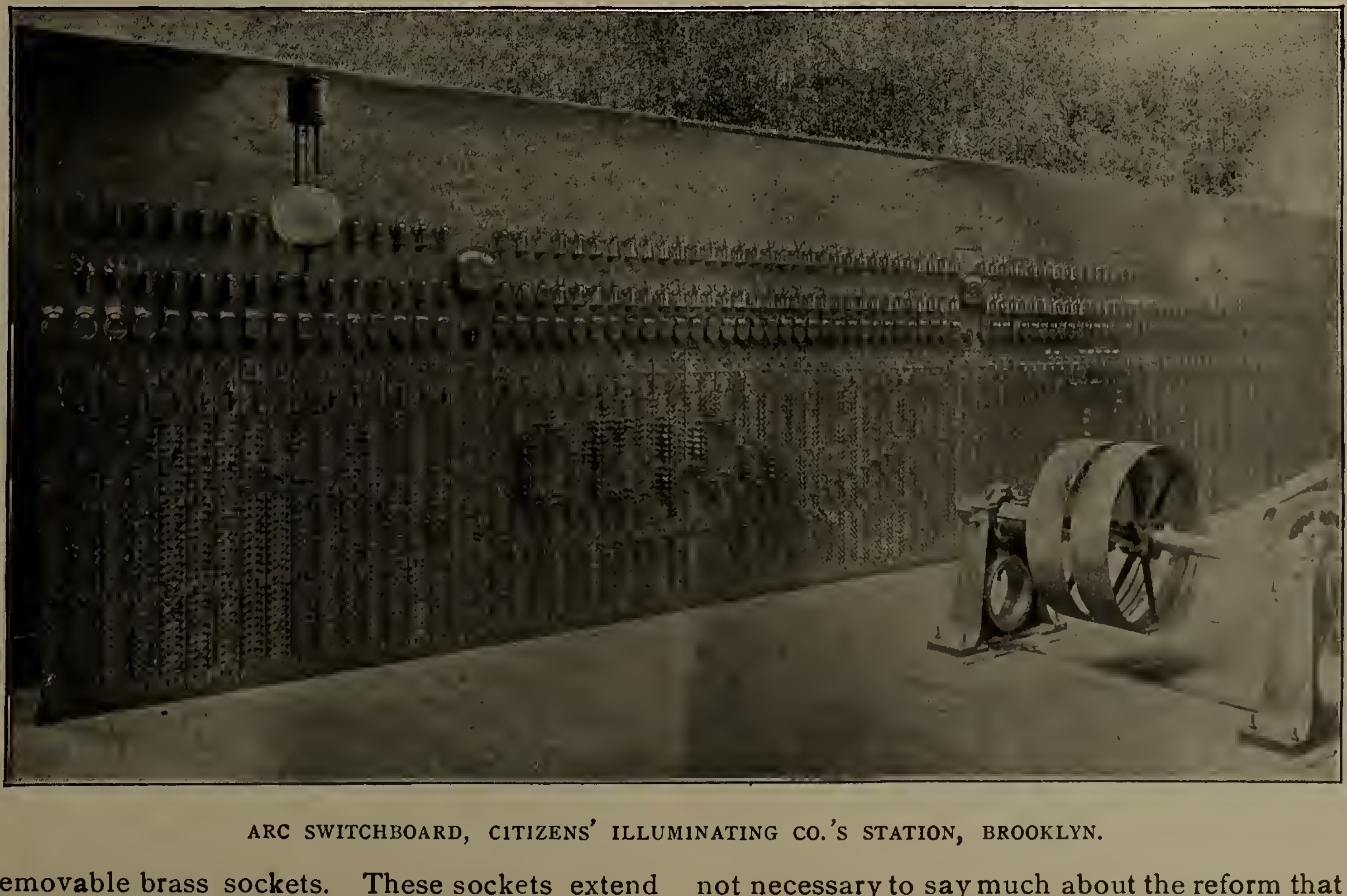


STATION OF CITIZENS' ELECTRIC ILLUMINATING CO., BROOKLYN.

and bottom. The circuit terminals are vertical strips of brass, three-quarter inch by one-quarter inch, to which are fastened removable brass sockets. These sockets extend partly through the slate, but do not touch it, the holes in the slate being bored large enough to prevent this. Horizontal strips of brass, supported eight inches in the rear of the board by means of iron bolts fastened to the slate, represent the dynamo terminals. Brass sockets are attached to these strips in the same manner as those to the circuit terminals. A brass plug is used as a connecting link. Precaution has been taken to insulate every piece of live metal from the slate by means of hard rubber. It is impossible by any means to get into contact with a piece of live metal from the front of the board. At the top of each panel is an absolute cut-out, by means of which a circuit may be connected or disconnected without the use of the brass plugs. In other words, a dynamo engineer may plug the entire board up at his leisure, and then use these cut-outs for the final connection at the proper starting time. They also serve as a quick means of disconnecting circuits in case of accident. The balance of the board is made up of a series of slate slabs, to which are fastened 192 Thomson-Houston lightning arresters, 96 Weston ammeters, especially designed for the work, and three Weston voltmeters connected with multipliers and ground-detecting switches. The whole board is 54 feet long and 13 feet high, and is one of the largest in the country. The board was manufactured by V. Prentiss & Co., from designs furnished by General Superintendent E. F. Peck, of the Citizens' Company.

The offices, stock-room, and testing department are on the third floor, and are handsomely furnished and well equipped. The officers of the company are as follows: Bernard Gallagher, president; James Shevlin, vice-president; John Delmar, secretary; Thos. F. Nevins, treasurer, and Edward F. Peck, general superintendent.

Fire Rules.—The Institution of Electrical Engineers, London, has formed a technical committee for the pnrpose of revising the old rules, and, if necessary, suggesting new ones for house wiring. It is not necessary to say much about the reform that is needed, says the London *Electrical Review.*



ARC SWITCHBOARD, CITIZENS' ILLUMINATING CO.'S STATION, BROOKLYN.

THE BOYNTON MULTIVOLT BATTERY.

A current of 5 amperes at a pressure of 5 volts from one cell of primary battery is a result apparently contrary to all scientific facts and laws, but it is an accomplished fact in the Boynton Multivolt Battery. This remarkable cell has just made its bow to the public and seems destined to become very popular.

One cell produces the same amount of current that requires at least three cells of ordinary battery to generate. This one important fact means that a battery of this type, to produce a given amount of light or power, occupies one-third the space that would be required for any ordinary battery of similar power, and as regards first cost, labor and cost of maintenance, the same figures hold good.

The claim that this cell could produce a current of over 5 amperes at more than 5 volts led a representative of the Electrical Age to the office of the Boynton Multivolt Battery Company, at 10–14 Whipple street, Brooklyn, N. Y., to investigate the same. In his presence a cell was tested and measured with a Weston ammeter and Weston voltmeter. On open circuit the cell showed an electromotive force of 5¼ volts, and on short circuit it gave a current of 5 amperes. The cell was then run on short circuit for 20 minutes and the current reduced to 2 amperes. It then measured $3\frac{6}{10}$ volts at the terminals with two currents running.

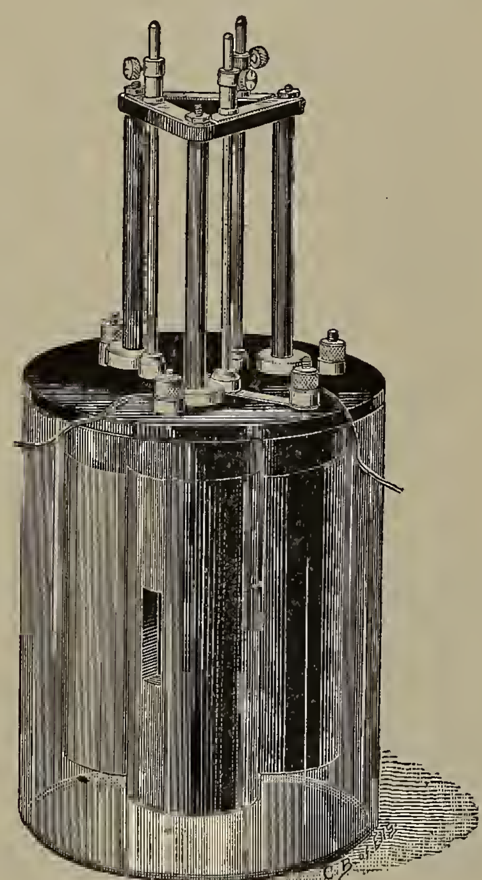


FIG. 1.

Four cells of the battery lighted up a 10 candle-power, 25-volt incandescent lamp with intense brilliancy, and one cell was sufficient to run a good sized fan motor.

For the further illustration of the strength of the cell a small model of an electric car was operated on a length of track, erected along one side of the office. With one cell the car made to and fro excursions with comparative great speed.

The multivolt cell is of the one-solution type, its great power being the result of a peculiar method of grouping and combining the elements; also in the manufacture of the carbon element.

The positive element consists of a cylindrical cup of carbon. The outer surface of the carbon is covered with a tightly fitting shell of vulcanized rubber, to within about an inch of the top, open end. Around this exposed rim of carbon, inside and out, is cast a ring of solder to give a large and firm contact surface. The casting forms one piece over the top edge of the carbon, and the union between the metal and carbon is further strengthened by the metal running through holes bored through the carbon before the casting is done.

A few holes are provided in the carbon and its hard rubber covering, near the top and bottom of the cylinder, but on one side only. These holes allow the circulation of the exciting fluid within the carbon cup.

In the standard cell three such carbons are provided. They are attached to the hard rubber cover which supports hem in the liquid.

Perforations through the cover admit an ordinary Leclanche zinc into the interior of each carbon cup. The zincs are supported on a frame, which permits of raising and lowering them from and into the liquid.

The cell is filled with the exciting fluid to within an inch or so of the top of the hard-rubber covering of the carbons, the zincs are lowered to the desired depth, and the cell is ready for action.

The elements are connected in series, zinc and carbon alternately, and the current is varied by increasing and decreasing the immersion of the ziuc.

Each pair of elements is provided with terminal posts, so that it is possible to get one-third, two-thirds or the full voltage of the cell, according to the number of pairs in circuit. This cell, therefore, provides means for varying both the electromotive force and current, according to the necessity of the case.

The outside surface of the carbon being insulated from the liquid by its hard-rubber cover, only the inside surface is acted upon. The result of this method of construction of the carbons is to give from the three groups of elements an E. M. F. of over five volts, although there is really but one cell of battery.

Electropoin fluid may be used in this cell, but for convenience the company furnishes an "electric sand," or powder, which robs the work of recharging of all its terrors.

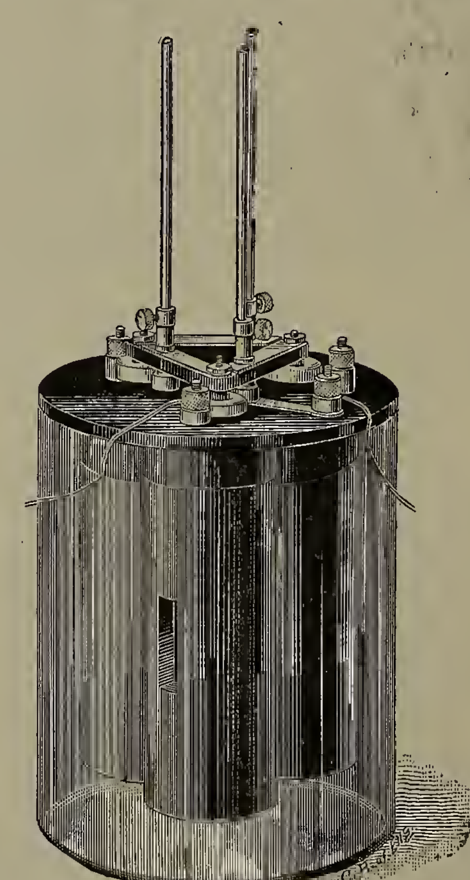


FIG. 2.

The standard size of the Multivolt cell is 6x8, but in one cell the power of three of ordinary make is produced.

Fig. 2 shows a standard cell with the zincs fully immersed, fig. 1 showing the zincs withdrawn from the fluid.

This cell will undoubtedly meet with great favor on account of its great power, and the important advantages it offers in the matter of economy in cost, space, and maintenance.

It is especially adapted for light and power purposes, and for cautery and electro-therapeutic work it will be found especially valuable. It has many virtues to commend it.

This cell is the invention of Mr. E. S. Boynton, vice-

president and general manager of the Boynton Multivolt Battery Company. Mr. Boynton has had large experience as an inventor of electrical appliances. He is the inventor of an electric motor which is remarkable for its simplicity of design.

The business end of the company is looked after by Mr. Charles H. Brigham, who has had an experience that will be found of the utmost value in building up so promising a business.

A MAGNETIC TESTER FOR MEASURING HYSTERESIS IN SHEET-IRON*.

BY PROFESSOR EWING.

Makers of transformers are now generally alive to the paramount importance, from the point of view of all-day efficiency, of using iron in which the hysteresis losses are small. The need, however, is felt of some simple means by which this quality can be readily determined. Tests made by the ballistic and other methods have shown that different samples of iron may exhibit extraordinarily wide differences in regard to hysteresis. The author has found, for example, in the course of his own tests of iron supplied for transformers, a range of nearly three to one in the

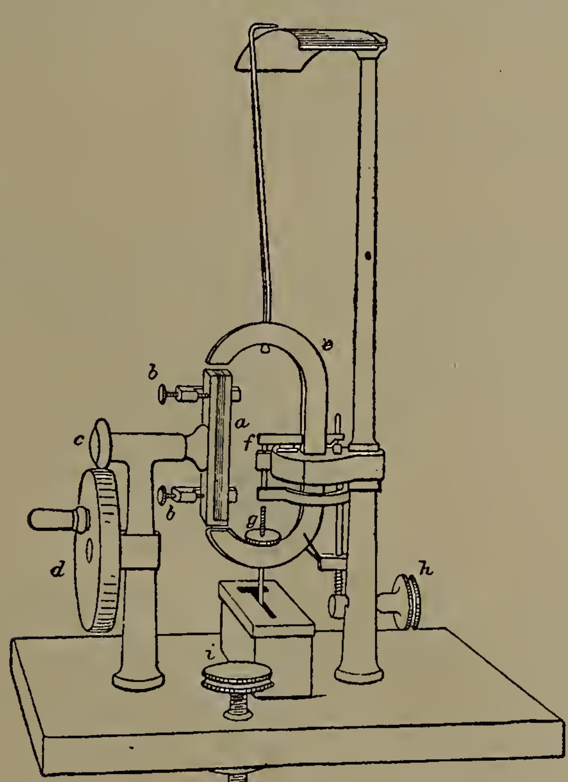


FIG. 1.

hysteresis of good and bad samples. It is unnecessary to point out how much the all-day efficiency of a transformer working under ordinary conditions will be affected if the sheet-iron used in its construction has three times as much hysteresis as it need have. Again, experience shows that even in one batch of plates of the same rolling so much difference is apt to exist between one plate and another as to make the testing of a single sample furnish a poor guide to the average quality of the batch. Even in a single plate samples cut from different parts show marked differences in hysteresis. The author has noticed as much as 15 per cent. variation in samples taken from the four corners of a plate not quite two feet square, the material of which was of very excellent quality. It is well known that different analyses of the nearly pure iron, of which such plates are rolled, exhibit corresponding variations.

The impurities appear to be unequally distributed, and, further, it is not unlikely that the irregularities which are found in the magnetic quality depend in part on slight differences in the treatment as regards annealing. Whatever their cause, there can be no doubt that they exist, and their existence makes the result of a single test often somewhat fallacious. What is wanted is a sufficiently large number of tests, in any one batch of iron, to allow a fair average to be estimated for the quality of the batch.

To make this possible a simple and expeditious method of testing is imperative. The ballistic method, although unimpeachable on the score of accuracy, is anything but expeditious, and can scarcely be called simple. The value of the hysteresis is arrived at by first observing the relation of the induction, B, to the magnetizing force, H, for a considerable number of points in each of a series of cyclic processes of magnetization, then drawing the B H curve for each of these cycles, and measuring the enclosed area. The operation requires some skill and experience, and a good deal of patience. The same criticism applies to the other methods of finding the hysteresis by first finding the relation of magnetism to magnetizing force—as, for instance, by the permeameter or by the author's magnetic curve-tracer. It must be borne in mind that in the testing of transformer iron the permeability is a quite secondary matter. What is of primary importance is the hysteresis, and high permeability is not necessary or invariably found associated with small hysteresis. In the testing of sheet iron by the ballistic method the finding of the relation of B to H is a step in the process; it is not the object of the test.

These considerations have led the author to devise an apparatus which measures the hysteresis directly by a single operation, and in a manner sufficiently simple to allow the test to be applied to numerous specimens without much expenditure of time, trouble or iron. The basis of the instrument is the mechanical measurement of the work done in causing reversals of magnetism to take place in the iron under examination. Such measurements have been made before as a laboratory experiment and under special conditions. Thus Mr. L. R. Wilberforce and the author, two or three years ago, endeavored to determine the hysteresis of a cylinder of iron when rotated in a strong magnetic field by measuring the couple required to keep it slowly turning; and a method of the same general character has been employed with complete success by Mr. F. G. Baily to investigate the disappearance of hysteresis which takes place in such a cylinder when the field is made sufficiently strong—a matter of great interest in connection with the molecular theory of magnetism. In the machine now brought forward as a practical tester for workshop use the same mechanical principle is involved. The process of reversal, however, resembles that which occurs in a transformer rather than in a dynamo; the induction is caused to have practically the same value in all samples, and that a value appropriate from the transformer point of view; the sample is cut in a very simple form, and is arranged to be readily inserted and removed. The magnetism is reversed by turning a handle, and the result is given by the position of a pointer on a scale.

Fig. 1 is a drawing of the instrument now exhibited, the form of which has been reached after a good deal of experiment. The iron to be tested is cut or stamped in the form of strips, which are 3 in. long and $\frac{5}{8}$ in. wide in this instance. The number of these pieces that is taken to compose the sample depends on the thickness of the sheet; six or seven pieces will in general be sufficient for the usual gauges of transformer iron, and a smaller number if the material tested is the thicker sheet used in dynamo armatures. The bundle of pieces forming the sample is placed in a carrier *a*, and is covered with a vulcanite washer and secured by two clamps, *bb*. The carrier is made to rotate by means of the friction pulley, *c*, and driving wheel, *d*. This causes the sample to revolve between the poles of the permanent magnet, *e*, with the effect that its magnetism is periodically reversed. The work done in reversing the magnetism, in consequence of hysteresis, causes a mechanical moment to be exerted by the revolving sample upon the magnet; and the magnet, being supported on a knife-edge at *f* in line with the axis of the carrier, tends to follow the sample and is deflected through an angle which serves to measure the work expended. Since a definite amount of work is done per reversal, whatever the frequency (so long as that is not so high as to make a sensible addition to the work by inducing currents,) the deflection of the field magnet is independent of the speed at which the carrier revolves, and no special care has to be taken to turn the handle at a uniform rate. If the rate is very slow the magnet will show each individual impulse

* *Electrical Engineer*, London.

which it receives as the ends of the sample pass its poles, but when the speed is sufficiently raised these impulses blend into a steady deflection; and the speed may be further augmented, to the extent of doubling it, or more, without making the deflection change. It is only at higher speeds still that the effects of induced currents become apparent. The deflection is observed by means of a pointer and scale above the magnet. The swinging of the magnet is checked by means of a dash-pot below, consisting of a vane, or spade, moving in a box filled with oil. The stability is adjusted to give any required degree of sensitiveness by means of the weight, *g*, which travels as a nut upon a screw fixed to to the magnet, and serves to raise or lower the centre of gravity of the oscillating system. The magnet swings about a knife-edge working in an agate trough, and a lifting arrangement like that of a balance is provided, operated by the handle, *h*, to save the knife-edge from unnecessary wear or injury. The pointer is set to zero in the middle of the scale by means of a nut which runs on a screw projecting sideways from the middle of the magnet, and a more delicate adjustment of the zero may be effected by means of the levelling screw, *i*. In operating, the observer inserts the sample and secures it by the clamps, then begins to turn the handle and lets the magnet down on its knife-edge. After reading the deflection of the pointer to one side he reverses the direction of rotation, reads the deflection to the other side, and takes the sum of the two readings as the total deflection. The deflection is proportional, or very approximately proportional, to the hysteresis of the iron even when samples widely different in quality are compared.

To secure that this shall be so, a considerable air-space is left between the magnet poles and the ends of the samples, with the result that such variations of permeability as are liable to be met with in different samples are almost without influence upon the total induction through the iron. The author has examined the induction by means of a search coil wound around the sample, and has found it to be practically the same in the best and worst specimens of transformer iron. The dimensions and strength of the field magnet are so proportioned, with reference to the section of the sample and to the extent of the air-gaps, as to make the induction have a value fairly representative of transformer work. In the instrument shown the induction is about 4,000 C.G.S. units with the normal size of test sample. By increasing or reducing the area of section of the sample the intensity of the induction is reduced or increased. Within reasonable limits, however, any value of this intensity may be adopted in testing, for it is known from the results of ordinary ballistic tests that curves drawn to show the relation of the hysteresis loss to B preserve their relative positions, through a wide range of values of B. In other words, the relative amounts of hysteresis in different samples do not change, or scarcely change, when the iron is more strongly or less strongly magnetized. This, of course, follows from the fact that a formula of the type originally suggested by Mr. Steinmetz,

$$\text{Hysteresis loss} = c\,B^n,$$

is practically applicable, c and n being constants, within limits which are more than sufficiently wide to include the inductions used in transformers.

In cutting the pieces which are to make up the sample care has to be taken to make the length always the same, otherwise the air-gaps, and consequently the induction, will vary irregularly. The carrier is formed so that it serves on a length gauge, and to facilitate the preparation of the samples a supplementary gauge is furnished in the form of a clamp of hardened steel, in which the strips are readily filed to the exact length after being cut a trifle too long. The width of the pieces requires no particular care.

The author was under the expectation that it would be necessary, in making an accurate comparison of quality between different specimens, to give the sample the same weight in each case in order to make it have the same cross-section. He finds, however, that no nice adjustment of the weight is required, provided advantage is taken of a property which will be most easily explained by citing an experiment made with the tester.

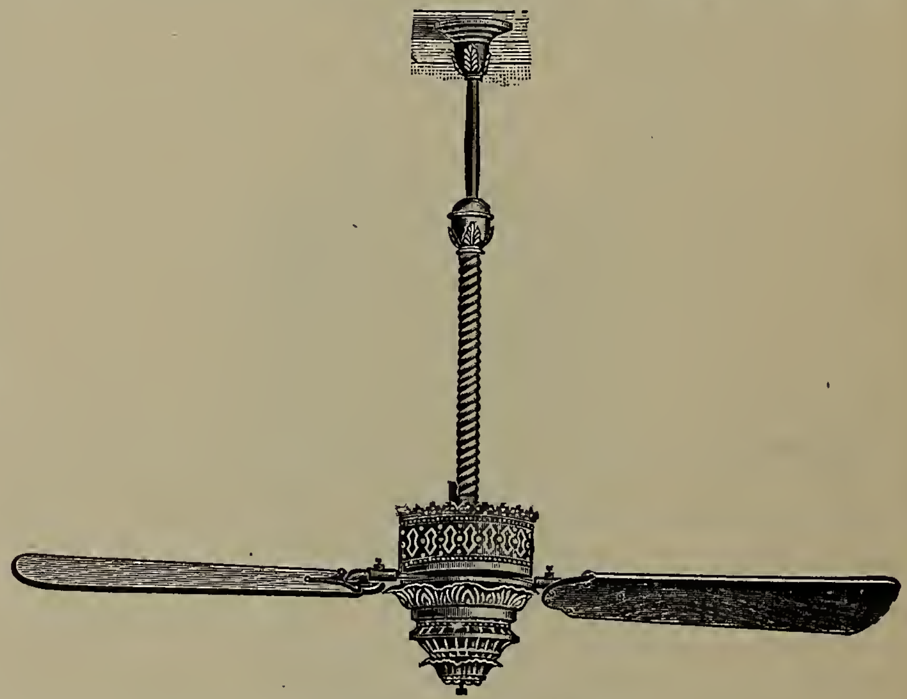
The experiment in question shows the effect of varying the section of the iron by varying the number of strips which make up the sample. Eleven strips of thin transformer iron were taken, each three inches long by five-eighth-inch wide, cut from the same plate. These were all used to form the sample in the first instance; then one was removed, and the remaining ten were tested, then nine, and so on, until finally the sample under test consisted of a single strip. The following are the scale readings for this, and also for another exactly similar experiment, which was made with a different specimen of transformer iron, of a poorer quality than the first. The two specimens are distinguished as A and B:

Number of strips in sample.	Scale readings of magnetic tester. (Specimen A.)	(Specimen B.)
11	72	118
10	71	117½
9	70	117
8	69½	116½
7	69	116½
6	69	117
5	69	120
4	71	124
3	75	132
2	85	142
1	69	130

MESTON A.C. CEILING FAN.

Among the best known alternating current fan motors none have a better name than the Meston machines, which have been on the market for the past five years. In that time they have earned an excellent reputation, which, of course, is gratifying to the manufacturers.

We illustrate herewith the Meston A. C. Ceiling fan motor of 1895. This fan is handsome in design, noiseless



MESTON CEILING FAN.

in operation and gearless. The speed is variable, enabling a gradation of the breeze generated.

The motor is operated by a current of 16,000 alternations at 50 volts and is very reliable in its action. The fan revolves at a speed of from 140 to 150 revolutions per minute. These fans are finished in nickel, oxydized copper and polished brass, and very ornamental in design. The metallic motor brush requires practically no attention whatever during a season's run.

Mr. N. M. Garland, 112 Liberty street, is the general eastern agent for Meston fan motors.

—Standard motors for street railway work are now designed to give a twenty-foot car, loaded, a speed of from 20 to 22 miles an hour on a level, and to develop their full rated capacity at a speed of 10 miles an hour.

PRINCIPLES OF DYNAMO DESIGN.

BY

Newton Harrison E.E.

PART II.

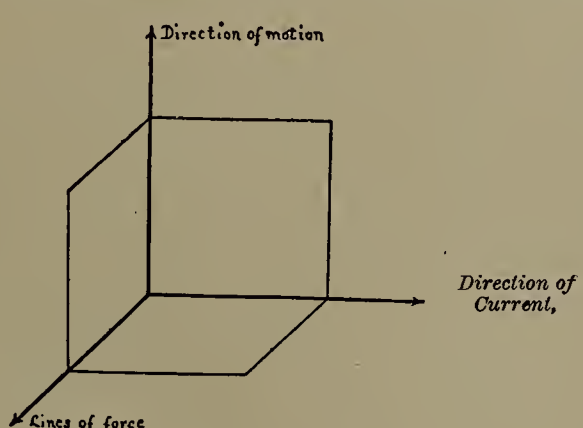
THE GENERATION OF ELECTROMOTIVE FORCE.

(*Continued from Page 267.*)

The most important function of a dynamo, or in fact of any piece of apparatus dignified by such a title, is the production of an electromotive force.

About the process by which an electric pressure is set up in a wire, sufficient is known to at least enable us to predict the result of a given set of conditions. But about the fundamental change occurring, the subtle process by which the magnetic force and copper wires react upon each other, so little is *actually* known that we may conclude investigations leading to no fruitful results.

The laws governing such reactions, however, are part of a definite and useful groundwork upon which we base the construction and design of many varieties of ma-



chinery. The simple fact that the sudden movement of a wire through a magnetic field sets up in the wire an E. M. F. was to Faraday sufficient evidence that an extensive application could be made of the principle. The original basis of so remarkable an experiment seems to have been suggested by Barlow's wheel, which involved the principle of the motor, and might have led to the discovery of the disk-dynamo had the ingenuity of the inventor been of a less limited nature.

With a magnetic field and a conductor cutting it at right angles, or a stationary conductor past which a field of magnetic force is moved, an E. M. F. is set up, the amount of which can be exactly ascertained by the proper methods. When the expression E. M. F. is used, it must be understood that it is not necessary to have a current flowing in order to feel assured of its existence. The effect producing a difference of potential between the ends of the wire is a purely static one. The current flow is only due to the incidental path formed by some conductor of high or low resistance joining the extremities. The difference of potential continues to exist as long as E. M. F. is generated by the movement of the conductor in the magnetic field, or vice versa. To thoroughly comprehend the reasons, as far as they are known, by which the direction of a current flow is determined, let it be at once understood that a conductor moved in front of a north pole would have a current passing through it whose direction would reverse, were the movement continued under a south pole.

Thus we see that opposite polarities have opposite effects, under such circumstances, upon a given conductor following a definite path. These facts have given rise to a rule by which it is possible to determine the direction of flow in a closed circuit moved in a magnetic field.

This rule, called Ampere's rule, is as follows :

Suppose a man be swimming in a conductor facing the direction of the lines of force, if the conductor be moved toward his right hand, he will be swimming with the current.

There is a method requiring the application of the thumb, first and second fingers for the consideration of the same fact. The thumb and forefinger are extended at right angles to each other, and the second finger at right angles to the forefinger, so that all three might be understood as representing the three diverging edges of a cube. If the thumb represents the direction of motion the forefinger the direction of the lines of force (from north to south) then the second finger will indicate the direction of flow of the current.

This is of use in cases where the direction of flow is to be speedily determined.

Another fact which would immediately meet with notice would be the resistance experienced as the speed of rotation or rapidity of motion of the coil increased. It would be simply necessary in this case to make use of a resistance that was capable of variation, and with every increase of current a stronger development of muscular energy would be required to overcome the invisible but existing opposition.

This is but the necessary outcome of a universal law, the law governing the development of energy. It is comparable to the reaction of striking bodies, being in fact a true reaction. Lenz has formulated a law which completely covers this important fact :—"In all cases of electro-magnetic induction the induced currents have such a direction that their reaction tends to stop the motion which produced them." In other words, if an electromotive force is developed and applied to any special purpose so that the current consumption increases, with every increase of current more mechanical energy will be required to overcome the increasing retardation. Because the very currents which are being produced are reacting upon the field producing them, and thus necessitating a constantly increasing consumption of energy.

This is the experience of an engineer in charge of a plant. As the current taken from the dynamo increases the amount of steam consumed also increases, because the engine, feeling the additional strain, makes greater call upon the boiler, and naturally upon the amount of coal burnt under it. So that we see a reason that is worthy of mention for the fact that with increasing current we need increasing power.

These rules, so rapidly reviewed, are of great importance, because they account for the energy output due to any electro-magnetic reaction and right means for governing the direction of flow.

(*To be Continued.*)

MINIATURE ELECTRIC LAMPS.

Many varieties of lamps are arranged to take their current from batteries. Among these is the one candle-power miner's lamp, of a flat shape, with metal loops at top and bottom, so that it can be hooked upon springs in the miner's lantern and held steady. The lamp and battery together are not heavy. Then there are bicycle lamps, microscope lamps and lamps for medical and dental work. Some of the lamps used for illuminating the interior of the mouth, throat and nose, are extremely small, generally cylindrical in shape, a quarter inch or less in diameter, and from half an inch to an inch long. But the tiniest of all is the "pea" lamp, a glass sphere one quarter of an inch in diameter.

Incandescent lamps are very much used for signs and advertising devices of all kinds, and one of the most ingenious arrangements of this kind is the "universal sign," on which the letters can be changed with the greatest ease, and any desirable combination made. Two copper conductors, a positive and a negative, are run the entire length of the sign. The electromotive force between them is sufficient to operate eight one candle-power lamps in series, so that the letters are made up of sets of eight lamps.

ELECTRICAL FIRES.

At the request of the executive committee of the Philadelphia Fire Underwriters' Association, Inspector William McDevitt, of the electrical department of the association, recently gave a series of demonstrations illustrating ignitions from defective and unskilful electric wiring.

In his opening remarks, according to the *American Exchange and Review*, Mr. McDevitt dwelt upon the necessity of considering the increasing use of electricity as a fire question, especially in view of the general introduction of the trolley motor, and also the tendency toward complete electric equipment in modern dwellings, both as to incandescent lighting and gas lighting systems. Many fires which had heretofore been a puzzle to fire authorities, the inspector thought, gave evidence of electric origin; and in most electric fires the primary reason of ignition has been lack of precaution and unscientific installation; consequently, the importance of employing skilled labor in the wiring of buildings, and of setting a high standard as to the quality of materials used grow more imperative. The inspector then proceeded to give a demonstration of ignition, which was directly referable to carelessness in relation to the incandescent lamp.

"I believe," he said, "that the general public are aware of the danger of enveloping the incandescent bulb with any fabric that shall confine the hot air and exclude the air from without. From past experiments that I have publicly made, and from actual fire occurrences, we have come to understand that it is dangerous to enclose the bulb with any material, even a fabric as light as mosquito netting. The danger is not restricted to the bulb; this (holding up an incandescent lamp socket) contains a form of fire hazard due to carelessness in setting up. The ends of the two wires that lead to a light are composed of filaments of smaller copper wires, put in contact with the lamp itself by being wound around binding screws and then fastened down. If any of the finer wires escape the notice of the workman, and become separated from the main bundle, there is liable to be a short circuit from contact with the metal shell of the socket; and should the fixture happen to be bound or draped with any decorating fabric, ignition is almost sure to take place." To illustrate his remarks on that head, Mr. McDevitt wound some gauze around a socket that had been previously short-circuited by unwinding some of the strands; and on passing a 100-volt current through the lamp the metallic socket at once burnt out, and set fire to the gauze with a sudden explosion.

The next experiment was a reproduction of a fire that had been started by a live wire grounding with a gas pipe. A light wire was put in loose contact with a ½-inch (internal diameter) gas pipe, through which a flow of gas circulated. On closing the switch that completed the circuit between the pipe and wire, the latter burnt a hole in the pipe in three counted seconds, igniting the gas and making a blaze a foot and a half long. Several specimens of pipe taken from electric fires were passed around for inspection, one being particularly noteworthy from the fact that it had been eaten through by streams of dripping water, which completed the ground circuit. About seven inches of the pipe had been pitted through by the action of the intermittent sparking, allowing the burning gas to escape from a number of small holes.

The pendant cord, characterized by the inspector as the "bugbear" of electric wiring, was then experimented on by bringing a frayed end in contact with the wire that completed the circuit. The silk insulation immediately took fire, and a foot of it burned until forcibly extinguished as it hung in the air. The great danger of flexible cords was shown to be their brittleness and rough handling by people who overestimate the use of portable lights. The first wrapping of wires was originally cased in a soft rubber tubing wound on the outside with silk or cotton covering. Experience proved that rubber was conducive to high flaming, and also afforded good material for a wick. Rubber has since been abandoned by the Philadelphia Fire Underwriters' Association, and the length of the cord restricted to six feet.

A number of conduits were then displayed as examples of the modern house wiring conduit system. The first of these was an ordinary conducting wire covered with a *papier mache* envelope soaked in a preparation of oil, the whole encased in partially flexible asphaltum tubing, flaked with silica glass on the outside. These conduits are comparatively safe, and are in general use in all the large cities of the United States. They are not absolutely fire-proof, however, nor free from risk of abrasion, and will in time be superseded by metallic casings. The first step toward metallic coverings, by which a wire is isolated from all danger of external contact, is in the use of thin brass tubing to cover the asphaltum. In several instances the brass has been known to give way under pressure, allowing the inner coverings to become exposed to further mutilation. The board of underwriters now recommends the use of ordinary iron gas-pipe with curved elbows. To show the superiority of the conduit system over unprotected wires, a length of about twenty feet of insulated wire was run through a six-foot brass tube containing the regulation asphaltum. The wire was coupled in circuit with three incandescent lamps, and, on the addition of ten more lights, the part of the wire outside the conduit began to smoke in less then five minutes and burst into flame. Part of the insulation and the molten copper dropped to the floor, while the wire in the conduit was found on removal to have sustained little injury.

As a final demonstration, another, and entirely new source of electric fire, was brought up, the result of investigations made a short time ago in the case of the Vanderbilt mansion fire in New York city. The fire was caused by the protruding ends of an incandescent light wire coming in contact with a metallic wall-covering stuff, composed principally of Dutch metal in the warp. Dutch metal is a brass alloy, rich in copper, and it is a good electrical conductor when woven into other fabrics in threads. Mr. McDevitt procured a small sample of similar goods and tacked it on a board, running two wires through holes in the back until their bare ends projected in front, in the same manner as wires are left sticking out of walls before the final adjustment of lamp sockets. On establishing a circuit through this piece of goods, a brilliant shower of sparks fell from the point of contact, and the fabric was in a blaze in an instant. The experiment gave evidence of the great risk in private houses of a wealthy class, where the tendency is toward metallic ornamentation, both in Dutch metal wall-papers and in fabrics that contain metal thread. The woof of such fabrics being cotton or hemp, the flammable quality of the material is preserved, and a good subject for ascending flame is provided, especially as the fabric hangs somewhat loosely on the walls where it is placed.

In conclusion, Mr. McDevitt remarked that such expositions might be taken as belonging to Philadelphia's contemporary reputation of always hunting for trouble, but claiming, so far as comparative knowledge of electric fire outbreaks is concerned, that Philadelphia holds the lead, it is proper that Philadelphia should give evidence of the character of this trouble. He said further, that the experiments were intended for public education, and expressed the wish that through the medium of the press, facts relating to the every-day fire hazards of electricity might be made matter of general knowledge.

The voltage used throughout was 100, a low figure in comparison with the three to five hundred volts employed on the trolley circuits, with their high voltage proportionately more fire making when invading other imperfect systems. The experiments were conducted with practical apparatus, and were successful as showing in a simple way the many subtle causes that may bring about fires.

—An incandescent lamp gives off about one-tenth the heat of equivalent gas light, and an arc light about one-fiftieth.

—Thin arc light carbons give brighter light with a given current than thicker ones, but they are consumed faster.

MEANING OF THE RECENT UNITED STATES PATENT DECISION.*

BY BENJAMIN PARK.

The whole effect of this final settlement of the question cannot be safely estimated, because no one knows all of the patents which may be influenced. In New York the existing injunctions under the Edison incandescent lamp patents have already been dissolved, and this course will undoubtedly be followed in all other parallel instances. The Berliner and early Edison telephone patents cease to be bugbears to telephone inventors.

But certainly a new crop of old questions will now arrive, and the patent lawyers are busily furnishing their reminiscenses of them in expectation of future frays. For example, since an invention "patented in a foreign country" is the limiting cause, what does "patented" strictly signify? Patented in the sense of United States law, or patented in the sense of foreign law, or merely *prima facie* patented. And if the thing *prima facie* patented turns out never to have been actually and validly patented at all, what becomes of the later United States patent assumedly rendered void by the apparent foreign patent which *ab initio* had no legal existence?

Then there is the accidental suffering argument. The American patent is allowed. The inventor, taking advantage of the six months' delay, endeavors to arrange that the American patent shall issue here and a foreign patent be filed abroad on the same day, thus seeking to prevent one patent having any effect on the other. But, through some accident, his nicely laid plan fails. His letters of advice miscarry, his money draft is carelessly made out, snow blocks the railway and the mails are late, or the telegraph wires are down, a clerk somewhere takes an unexpected holiday, his cable dispatch is confused—any of these things may put the granting of the foreign patent ahead of that of the American; and the mischief is done. *Ergo*, the law is intolerable.

Or, to make matters even worse, there is the doubt as to whether the earlier granted foreign patent which limits must be that of the American inventor, or may be that of any one else. The statute contains no words of restriction whereby, in both cases, the patentee is to be one and the same person. Indeed, to insert such words now seems to be as much a legislative act as that of adding the other words which the Supreme Court refused to read in it. If this be true, woe betide the inventor who incautiously reveals the subject of his American application. There is nothing to prevent his enemy or competitor, learning thereof, from obtaining immediately an Italian patent which will terminate in one year, and thus the unfortunate applicant in the United States, who may be delayed in the patent office by its endless red tape for more than twelve months, may find his American patent dead, killed by his enemy's earlier Italian patent before he ever gets it from the patent office.

So the American patentee, until Congress shall relent and come to his relief, is left by the Supreme Court "between the devil and the deep sea." If he has his American patent granted first, and it gets over to Germany or England, for example, his patent in those countries, subsequently sought, will fall because of the so-called prior introduction of knowledge into the realm. If he has his foreign patents granted first, he may seriously reduce the term of his American patent. Of course there are ways of managing these things by dint of prudent foresight, quick and astute correspondents, and the Atlantic cables, so that the risks are reduced, and, in reality, the dangers to an inventor who keeps his secrets and applies for his foreign patents at the proper time, and in the proper manner, are much less formidable than they appear.

It is perfectly true that Congress is omnipotent in these matters, and can impose any conditions or terms upon the inventor which it sees fit as a condition precedent to giving him his patent; but the whole spirit and sense of our patent system favors the utmost liberality and consideration to the inventive genius of the nation, and is sternly against hampering or harassing it in any way. For this reason any attempt to impose recurring taxes upon patentees, or to compel them to "work" their devices, under penalty of forfeiture of patent, after the fashion of many foreign countries, has failed, and even the perennial grab of the Western granger at the $4,000,000 surplus now to the credit of the patent office in the United States treasury, for school purposes and other improper diversions of it, regularly comes to naught.

There can be little doubt that section 4887 does not serve any beneficial purpose, if it is not altogether mischievous in its effect. Public opinion is, and for a long time has been, in favor of the elimination of the limiting provision in it, but the obstacle to congressional action has chiefly been the strong prejudice against the corporate monopolies, the desire to curtail their privileges wherever practicable, and the consequent unwillingness to enact a new statute or amendment which should be retroactive, and hence amount to a virtual extension or rehabilitation of their patents, otherwise defunct. Now that the Supreme Court has spoken, Congress may regard the subject in a different light, and relieve future patentees of the objectionable conditions which the statute imposes.

* *Engineering Magazine*, May, 1895.

MOUNT VESUVIUS CABLE RAILWAY.

The summit of Mount Vesuvius is now attainable by a cable railway, built in 1879 by Thos. Cook & Sons. The power station is at the bottom of the track. It contains the 45 h. p. engine and boilers for working the cable, and also a dynamo for running the arc lights at night. The peculiarity of the track is the single-rail construction, which consists of wooden stringers laid longitudinally and carrying a single rail, upon which ride the central wheels of the car. There are, however, two other rails placed on either side of the base. These side rails are adapted to wheels whose axes project from the floor of the coaches and bear closely against the rails on either side of the sleeper, thus keeping the carriage firmly upright. Although the railway is only just over half a mile long it cost £16,000, a large proportion of which was expended in transporting materials for the railway. The maximum gradient is 63 per cent., and the journey takes 10 minutes. Each car carries 11 persons. The cable is of steel, ⅞ inches diameter, with hempen core. There are six strands of eight wires each. There are two cars, and as one descends the other is drawn up the mountain. Should the weight of the descending car overbalance that of the car going up, the brakes with which the winding-drums in the power house are equipped regulate the speed of the machinery.

ONE YEAR'S WORK.

About one year ago Mr. Fremont Wilson the well-known consulting electrician, on the advice of some of the most prominent insurance underwriters, organized the Bureau of Electrical Inspection, which has had a phenomenal development. The utmost confidence has been placed in Mr. Wilson's work, and through his careful inspection many crude and careless pieces of electrical wiring work have been revealed. Many prominent and trustworthy construction companies and individuals have been victimized by unscrupulous wire contractors, who do their work cheaply and in a slip-shod manner. Often they are incompetent or careless, or both, and in some cases much risk is entailed by allowing such work to be carried on. Mr. Wilson's duties are to discover such work and apply the proper remedy. In this work he represents 21 of the most prominent American and foreign insurance companies and agencies, and finds plenty to do. He has a reputation back of him for expert knowledge and personal probity. He is in every way qualified to fill this delicate and important position. His office is at 66 Maiden Lane, New York city.

ELECTRIC POWER IN MILLS.

BY A. F. MC KISSICK.

The first case of adoption of electricity in the South as a means of transmission of power for a cotton mill is that of the Columbia Cotton Mills at Columbia, S. C. In this case the mere transmission of power is of trifling importance, as the distance is only a few hundred feet. The turbines in the power house are supplied with water from the recently-developed Columbia Canal, and, on account of the location of the canal at this point, it would have been utterly out of the question to use direct belt transmission from the turbines. The question, then, was whether to build the mill nearer the turbines and use rope transmission, necessitating, however, excessive excavations, or to place the mill where it is now located—on a comparatively level site — and use electrical transmission. The latter was decided on, and the mill started successfully in April, 1894, and has been running since that time without the slightest hitch.

This plant consists of two 750-h. p. generators direct coupled to horizonal turbines, running at a speed of one hundred and eighty revolutions per minute. This low speed was necessitated by the low head and the desire to dispense with the loss of efficiency due to belting. The line is carried in an underground conduit to the hill, and there is distributed in conduit tubing to the various floors of the mill, where are located seventeen 65 h. p. motors, suspended in an inverted position, so as to take up the minimum of space and permit of direct belting to the short sections of shafting driven by individual motors. These motors have no moving contacts of any kind, and regulate within two per cent. in the matter of speed. This plant is of great importance as exhibiting the application of electricity in the distribution of power in small units. There are no long lines of shafting in this mill, no large belts or pulleys, and each room is independent of every other.—*Engineering Magazine.*

Refining Zinc By Electrolysis.—Mr. Joseph W. Richards has conducted extensive experiments in refining impure zinc by electrolysis. By using a current density of 100 amperes per square meter, at 1.3 volts tension per bath, and keeping the solution agitated by mechanical means, thick deposits of zinc of exceptional purity can thus be obtained. The accumulation of iron in the solution is prevented by blowing air through it continually, which oxidizes and precipitates the iron as basic sulphate, that can be separated by filtration. There is considerable loss in melting down the zinc sheets to ingot shape, but, notwithstanding this, the process could be operated commercially but for the very low price which zinc has reached within the last few years, the margin for profit being less than in refining copper, while the expenses are greater.

RAPID TRANSIT IN NEW YORK.

The Rapid Transit Commission, at its meeting on May 9, adopted a report upon routes and a general plan of construction. This, it is said, completes the work preliminary to getting public and private consents to the building of the projected roads.

The routes have already been described in The Electrical Age.

The report will be presented to the Common Council for action thereon. It says:

"The Board is of the opinion that the rapid transit railway, the routes and general plan of construction of which it now submits for your consideration, can be completely built ready for operation (exclusive of the equipment, which is to be furnished by and be the property of the contractor who shall operate the same) for less than the sum of $50,000,000."

The principal features of the plan of construction are these:

1. The tracks are to be placed substantially upon a level.

2. The railway is to be placed as near the surface as street conditions will permit.

3. The total depth of excavation necessary for the construction of the railway and its foundations will be in general only about eighteen feet, except in the centre of the street, where the depth will be about two feet greater. The elements which involve risk to the neighboring building have been almost completely eliminated, nor is any damage to abutting property to be apprehended in any case by the construction of the railway.

4. Below Park place, on Broadway, the present plan includes only two tracks. These will be placed in a tunnel 25 feet wide, and in the centre of the street. Old and large buildings like Trinity Church and the Astor House will not be exposed to the slightest danger.

5. The placing of the railway close to the street surface permits and requires an arrangement of sewers, water mains, gas pipes, electric conduits, and other sub-surface structures in Broadway from Park place to Thirty-fourth street, which will be most advantageous to the city and to owners of property on Broadway. It is proposed to construct, in connection with the railway and at the side of or beneath the tracks, large and well-appointed galleries in which all such pipes and conduits will be placed. These galleries, when at the side, will facilitate the better ventilation and lighting of the tunnel, and the space afforded by them will facilitate construction and repairs. The proposed galleries will be carried along Broadway from Park place to Thirty-fourth street. In making a contract for the construction and operation of the railway the Board will reserve to the city all revenue to be derived from the use of the galleries for any purpose except a purpose necessary to the actual operation ot the railway. The abutting owners on Broadway, after the construction of the road, will enjoy the great and, for New York, the unprecedented advantage of a street the surface of which need be disturbed only at long intervals, and then only to renew the pavements as they become worn by surface traffic.

6. The method of construction proposed by the Board is neither experimental nor untried. The work will be attacked at as many points along the route as may be considered desirable. The progress of construction will be expedited to the utmost, and the inevitable discomforts will be reduced to a minimum. The running of the surface cars is not to be suspended. On Broadway, south of Thirty-fourth street, except at Canal street, no more of the street surface is to be interfered with at one time than one-half on one side or the other of the centre line of the street. Openings are not to be more than 200 feet long, and consecutive openings are to be separated by free and undisturbed spaces of at least 500 feet.

7. The railway tracks are to be of standard gauge, so that the railway cars can be large and commodious.

BARGAINS IN VARLEY ELECTRIC BELLS.

The Varley Duplex Magnet Co., 64 Cortlandt street, New York, is offering some bargains in bells. It has from $1,200 to $1,500 worth of four to twelve-inch Varley bells, which it will sell at the cost of manufacture. These bells have cast gongs, cast-iron frames, with pivoted armatures. The Varley Company is dlsposing of these bells in order that it may devote its energies exclusively to the manufacture of electro-magnets of all styles and sizes.

This is a rare opportunity to get a stock of first-class bells at low cost. These bells are brand new, and guaranteed in every respect. They will go low in order that the stock may be quickly disposed of.

The Varley bells are absolutely dust-proof and bug-proof; the armature is pivoted, and the bell will not buzz, and the magnets are 20 per cent. stronger than single-wound magnets. The bell possesses many other important advantageous features.

THE TELEPHONE AND ITS OPERATION.

This is the title of a well-written and illustrated article by Morgan Brooks, in the May number of *Cassier's Magazine*.

While metallic circuits are fast coming into general use, Mr. Brooks says, there still remains a great many grounded circuits, and if connected directly together the value of the metallic circuit in suppressing inductive disturbances is lost. But if a "repeating coil" is used, the advantages of the metallic circuit are retained. The repeating coil is a special form of induction coil, preferably with closed magnetic circuit, in which the primary and secondary have about the same number of turns of wire. One circuit is connected with the grounded line, the other with the metallic circuit, and talking is carried on by induction. These coils are now so perfect that there is little loss in transmission, even with two in use at one time, as in the case of a metallic trunk line with grounded lines at each end. It is found that repeating coils may be used to advantage in the construction of long lines not wholly metallic. The metallic circuit may, for example, be carried from the exchange beyond the influence of an electric railway line, and joined through a coil to a long single wire running to some distant country subscriber.

Several schemes for overcoming the troubles of grounded lines, without going to the expense of doubling all wires, have been devised. Probably the most successful of these is the McCluer system, in which a carefully proportioned, common return wire joins the ends of a number of single wires, doing away with ground connections altogether.

The problem of multiplex telephony, or the transmission of several messages simultaneously over the same line, has attracted much attention. The well-known methods used in telegraphy do not apply to the telephone, and of the many plans suggested none has proved a commercial success. One system for combining telegraphy and telephony upon the same wire, that of Van Ryselberghe is in extensive use in Belgium. A satisfactory solution of the multiplex problem would cause the immediate extension of telephone trunk lines and their rapidly increasing use, since the rates for distant connections could be reduced from their present almost prohibitory scale. While the limit of telephonic conversation by land lines has not yet been reached, submarine conversations is, at present, restricted to about one hundred miles. Our descendants may talk across the Atlantic, but certainly not through cables constructed like those now used for the telegraph.

The stimulus given by the expiration of the original Bell patents, and by the recent cancellation of the Berliner patent, encourages the expectation of further advance in telephony. While the American Bell Telephone Company holds a well-nigh impregnable position as regards long-distance lines and exchanges in the larger cities, there remain to those now entering the field the vast reservations just opened to the public of private lines and exchanges for villages, factories, hotels, and public buildings, a field the fertility of which is as yet little understood.

STATUE TO PROF. HELMHOLTZ.—It is proposed in Berlin to erect a statue to perpetuate the memory of the late Prof. Von Helmholtz. A large number of subscriptions have already been received for the purpose.

New York Notes.

OFFICE OF THE ELECTRICAL AGE,
WORLD BUILDING, NEW YORK,
MAY 13, 1895.

The Manhattan General Construction Co., manufacturer of incandescent arc lamps and wire gauze dynamo brushes, and eastern representative of the Buckeye Incandescent Lamp Co., has moved its offices to the Edison building, 44 Broad street.

The F. P. Hampson Supply Co. was recently organized to deal in engineers' and mill supplies at 30 Cortlandt street. Mr. F. P. Hampson is manager and Jas. T. Brady treasurer. Mr. Hampson is the son of Mr. E. P. Hampson, of E. P. Hampson & Co., 36 Cortlandt street.

The W. C. Vosburgh Mfg. Co, 269 to 281 State street, Brooklyn, N. Y., has recently received contracts for the furnishing of lighting fixtures for the Tarrant County Court House, Fort Worth, Texas, and the Hotel Wescott, Richmond, Ind. The company has many other contracts on hand, and its factory is kept busy in filling these orders.

Mr. P. G. Monroe was recently elected president of the Master Steam and Hot-Water Fitters Association of the United States. Mr. Monroe's office is at 621 Broadway. He is well known to the electrical trade through his former connection with the *Street Railway Gazette* when it was published in Chicago.

Mr. George Pellinger, formerly superintendent of the Goodrich Hard Rubber Co., Akron, Ohio, is now a member of the Goodyear Vulcanite Co., 353 Broadway, New York. The Goodyear company is enlarging its works and otherwise extending its facilities in order to be better able to handle its rapidly increasing business.

Warren & Lozier, electrical repairs, etc., 465 Greenwich street, have one of the best equipped repair shops in the country. They put electric plants in first-class order, and do their work promptly and carefully. Their foot-ruler, which is being distributed among the trade, is very handy for the desk. If you want to reach this firm by telephone ring up 957 Franklin, and you have them.

We learn that the Bell Telephone Company has, through the New England agency, bought out the Ridgefield Telephone Co., Ridgefield, Conn. After the deal the Bell company's agents called up all the Ridgefield subscribers and informed them that they could be placed in communication with long distance subscribers all over the United States. The Ridgefield Company was using opposition instruments.

E. G. Wadsworth, manufacturers' agent, has opened offices in the new Liberty building, 123 Liberty street, and will carry a complete line of electrical, steamship and railway supplies. Mr. Wadsworth is ready to handle first-class goods for manufacturers. He has had a large experience, and is popular in these special branches of trade. With the ability and energy that he possesses he will develop a big trade in new channels.

The Law Battery Co. has moved into its new offices at 39 Cortlandt street. The company recently took possession of its new factory in Cranford, N. J., and is now building a new carbon plant for the manufacture of battery carbons for its own exclusive use. The company feels assured that it can produce carbons of more uniform quality than can be ordinarily obtained. They have heretofore found it difficult to obtain this material of sufficient uniformity to answer their purpose, and they think by making their own carbons they can secure exactly what they want. The company will bring out several new forms of batteries.

W. T. H.

Telephone Notes.

TELEPHONE PATENTS ISSUED, MAY 7, 1895.

TELEPHONE SYSTEM. James W. McDonough, Chicago, Ill. (No. 538,975).

The Palmetto Terminal Co., Palmetto, Fla., will construct a telephone line.

Mr. R. F. Hogsette, New Iberia, Fla., is interested in a project to build a telephone line from Abbeville to Garland Ranch, a distance of twenty miles.

Bailey & Lebby, Charleston, S. C., are interested in a new telephone company in that place, to be known as the Charleston Mutual Telephone Exchange Company.

A telephone company has been chartered in Jonesboro, Tenn., to construct a telephone line from Jonesboro to various places in the vicinity. Among those interested are Chas. Seymour, of Knoxville, Tenn., and Guy R. Johnson, of Embreeville, Tenn.

The Southwestern Telephone Company will begin at once the construction of an exchange in Hillsboro and Milford, Tex.

Chas. R. Pengilly, of Corsicana, Tex., is organizing a telephone line in Mexia, Tex.

Street Railway Notes.

George B. Wheeler, of Eau Claire, Wis., has been appointed as receiver of the Eau Claire Street Railway, Light and Power Company. The mortgage on this property was foreclosed by the Atlantic Trust Company, of New York.

It is expected that work will shortly be commenced on the Derry and Chester electric road, which is to run between those two New Hampshire towns.

The Lake Charles Electric Railway Company, Lake Charles, La., was recently organized to build an electric railway. Work will commence soon.

David E. Evans & Co., of Baltimore, Md., have secured the contract to build one and one-quarter miles of electric road for the City and Suburban Railroad Company, in that city.

The Algiers and Gretna Railway Company, New Orleans, La., is considering the advisability of changing its lines to the trolley system.

Possible Contracts.

An electric light plant will probably be established in Marion, Ala.

The City of Pulaski, Tenn., will issue $25,000 in bonds for the construction of an electric light plant.

S. H. Gilheman, of Springfield, Ill., is interested in a project to build an electric light plant in Enterprise, Miss.

It is reported that the Siemens & Halske Electric Co., Chicago, is negotiating for the purchase of the plant of the Grant Locomotive Works, Cicero, Ill.

Mr. Henry M. Flagler will require an electric light plant in his new hotel at Palm Beach, Fla. He will also put in a plant to light the Hotel Poinciana in the same place.

Sealed proposals for the construction of a new court-house in Baltimore, Md., will be received until July 8. F. C. Latrobe, chairman of the Court-House Commission, can give further information.

The William Wharton, Jr., Company, Philadelphia, Pa., it is reported, will erect an electric plant on the Chesapeake and Ohio canal, and will furnish electric power for factories in Williamsport, Pa., and Hagerstown, Md.

Address H. G. Chatham for particulars concerning the proposed electric light plant in Elkins, N. C.

The Consolidated Electric Light Company, Birmingham, Ala., will erect an electric plant.

Alexander City, Ala., is to have an electric light plant.

It is reported that the Kaukauna Electric Light Company, Kaukauna, Wis., has applied for a receiver. The company's capital is $50,000.

New Corporations.

The Harrington, Frederick and Denton Electric Railway Co., Denton, Md., by Robert W. Reynolds, Ezekiel Fleming, H. Harrington, B. L. Lewis, and others. Capital stock, $100,000.

The Electric Scale Co., Kittery, Me., by W. H. Doble, of Quincy, Mass , president, and H. F. Doble, of Quincy, treasurer. Capital stock, $60,000.

The Savannah Telephone Co., Savannah, Mo., by B. E. Egan, John Donald, L. N. Hooper, Jr., J. T. Hughes, and J. A. McLean. Capital stock, $10,000.

Philadelphia and West Chester Traction Company, Philadelphia, Pa., by W. F. B. Stewart, York, Pa.; W. C. Alderson, Overbrook; W. M. Rotch, Wistar, Germantown, and others. Capital stock, $181,000.

The Egg Harbor City Water, Electric Light and Power Company, Egg Harbor City, N. J. Officers: President, Dr. Theo. H. Boysen; secretary, Robert Ohnmeiss; treasurer, Harry May. They have obtained the contract to furnish the city with light and water. W. W. Taylor has secured the contract for the erection of the works.

The Southern Standard Telephone Company, Memphis, Tenn., capital stock of $4,000,000, to operate in Tennessee, Kentucky, and the Carolinas. The Southern organization is a branch of the Standard Telephone Company, capital $10,000,000, with headquarters in New York City.

The Chicago Heights Electric Company, Chicago Heights, Ill., by W. G. Caldwell. Capital stock, $50,000.

The Oshkosh Northwestern Telephone Company, Oshkosh, Wis. Capital stock, $20,coo.

The Interstate Long-Distance Telephone Company, Leavenworth, Kans., by W. T. Hewitt, W. N. Todd, J. W. Fogler, and others, to build telephone lines between Kansas towns and elsewhere. Capital stock, $100,000.

The Standard Telephone Company, City of Mexico, Mex., has been organized with a capital stock of $2,000,000.

The Fort Valley and Perry Telephone Co., Fort Valley, Ga., by C. W. Withoft, president; T. V. Fagan, vice-president; W. P. Harwell, general manager; Geo. L. Keen, secretary and treasurer.

The Bonham Telephone Co., Bonham, Tex., by H. C. Alexander, Benj. Dabney, and M. H. Johnson. Capital stock, $4,000.

Trade Notes.

The Cincinnati Corrugating Co., Piqua, Ohio, has issued an illustrated catalogue of its well-known corrugated goods. This company manufactures corrugated roofing, siding, ceiling, arches; corrugated laths, shutters, doors, etc., etc. It has a large plant and carries on a very extensive business.

Mr. R. Leo Van der Naillen, a Californian by birth, who has held many important positions on the Pacific Coast, has been appointed Western manager of the Boudreaux Dynamo Brush Co., with headquarters at Chicago. Mr. Van der Naillen is a practical engineer whose abilities will certainly be appreciated by all the Western patrons of the Boudreaux Dynamo Brush Co.

THREE-VOLT PRIMARY CELL.—The most powerful primary cell known is that described by Warren. It consists of magnesium in a solution of ammonium chloride and copper in a solution of cupric chloride and hydrochloric acid. It is claimed that this cell has an E. M. F. of three volts, and as its resistance is very low it furnishes a large current.

WOVEN WIRE BRUSHES.

The Belknap Motor Co., of Portland, Maine, are the patentees and manufacturers of the best woven wire commutator brush on the market.

Electrical and Street Railway Patents.

Issued May 7, 1895.

538,648. Alternating-Current Motor. Engelbert Arnold, Zurich, Switzerland. Filed July 10, 1894.

538,649. Closed-Conduit Electric Railway. George E. Baird, Chicago, assignor of one-half to William D. Henkee and Andrew Reiner, Blue Island, Ill. Filed April 30, 1894.

538,650. Closed-Conduit Electric Railway. George E. Baird, Chicago, assignor of one-half to William D. Henkee and Andrew Reiner, Blue Island, Ill. Filed June 11, 1894.

538,651. Telegraph-Key. Charles W. Bradford, Clinton, assignor of one-half to E. W. Boyer, Fairfield, Me. Filed Jan. 24, 1895.

538,669. Safety Device for Electric Motors. Rudolf Eickemeyer, Yonkers, assignor to the Otis Brothers & Co., New York, N. Y. Filed July 13, 1892.

538,670. Electric Transfer-Switch. Axel Ekström, Lynn, assignor to the General Electric Company, Boston, Mass. Filed Sept. 7, 1893.

538,686. Electric Time-Alarm Clock. Max Leibecke, St. Paul, Minn. Filed Feb. 28, 1895.

538,695. Electric Soldering-Iron. William H. Osborne, Prince's Bay, N. Y., and George R. Meitzler, Cincinnati, Ohio. Filed Feb. 13, 1895.

538,700. Electric Elevator. George H. Reynolds, New York, N. Y., assignor, by mesne assignments, to the National Company, Chicago, Ill. Filed Jan. 27, 1890.

538,721. Car-Fender. Henry A. Benson, Oakland, Cal. Filed Jan. 24, 1895.

538,744. Speed-Regulator for Electric Motors. Frank B. Rae, Detroit, Mich. Filed Aug. 28, 1894.

538,757. Dynamo-Electric Machine. Addison G. Waterhouse, Pittsburgh, Pa., assignor, by mesne assignments, to the Westinghouse Electric and Manufacturing Company, same place. Filed Feb. 4, 1889.

538,758. Preventing Electrolysis of Street-Pipes. Richard Watkins, Sacramento, Cal., assignor of one-half to John W. Guthrie, same place. Filed June 25, 1894.

538,764. Electro-therapeutic Apparatus. Franz Borsodi, Magyar-Banhegyes, Austria-Hungary. Filed Oct. 22, 1888. Patented in England Sept. 1, 1886, No. 11,529; in Belgium Sept. 15, 1886, No. 74,477; in Austria-Hungary Mar. 17, 1887, No. 5,105, and No. 5,199, and in France Aug. 13, 1887, No. 178,536.

538,773. Electric Tower-Clock. James H. Gerry and Frederick M. Schmidt, Brooklyn, assignors to the Self-

(*Continued on Page* 288.)

National Electric Light and Street Railway Associations.

NATIONAL ELECTRIC LIGHT ASSOCIATION.

President, C. H. WILMERDING, Chicago, Ill.; 1st Vice-President, FREDERIC NICHOLLS, Toronto, Canada; 2d Vice-President, E. F. PECK, Brooklyn, N. Y.

Members of Executive Committee: E. H. DAVIS, Williamsport, Pa, (one year); W. R. GARDINER, Pittsfield, Mass.; GEORGE A. REDMAN, Rochester, N. Y.; J. J. BURLEIGH, Camden, N. J. Next meeting, New York, May or June, 1896.

AMERICAN STREET RAILWAY ASSOCIATION.

Next meeting, Montreal, Que., October, 16, 17 and 18, 1895.

President, JOEL HURT, Atlanta, Ga.; Vice-President, W. WORTH BEAN, St., Joseph, Mich.; 2d Vice-President, JOHN M. CUNNINGHAM, Boston, Mass.; 3d Vice-President, Russell B. Harrison, Terre Haute, Ind., Secretary and Treasurer, WILLIAM J. RICHARDSON, Brooklyn, N. Y.; Executive Committee, HENRY C. PAYNE, Milwaukee, Wis.; W. H. JACKSON, Nashville, Tenn.; D. G. HAMILTON, St. Louis, Mo., C.C. CUNNINGHAM, Montreal, Canada; J. N. PARTRIDGE, Brooklyn, N. Y.

NEW YORK STATE STREET RAILWAY ASSOCIATION.

Next meeting, Albany, N. Y., third Tuesday in September. 1895

President, G. TRACY ROGERS, Binghamton; First Vice-President, JOHN H. MOFFITT, Syracuse; Second Vice-President, W. W. COLE, Elmira; Secretary and Treasurer, WILLIAM J. RICHARDSON; Brooklyn; Executive Committee, D. B. HASBROUCK, New York; JOHN N. BECKLEY, Rochester; DANIEL F. LEWIS, Brooklyn.

OHIO STATE TRAMWAY ASSOCIATION.

Next meeting, fourth Wednesday in September, 1895.

President, ALBION E. LANG, Toledo; Vice-President, W. J. KELLY, Columbus; Secretary and Treasurer, J. B. HANNA, Cleveland; Chairman Executive Committee, W. A. LYNCH, Canton.

MASSACHUSETTS STATE STREET RAILWAY ASSOCIATION.

President, T. H. CUNNINGHAM, Boston; Secretary and Treasurer, A. S. BUTLER, Lawrence; Executive Committee, SAMUEL WINSLOW, ALFRED A. GLAZIER, Boston; P. F. SULLIVAN, Lowell; E. C. FOSTER, Revere; HORACE B. ROGERS. Brockton; A. E. SMITH, Springfield; PRENTISS CUMMINGS, Boston.

THE TEXAS STREET RAILWAY ASSOCIATION.

President, W. H. SINCLAIR, Galveston; vice-president, C. A. MCKINNEY, Houston; Secretary and Treasurer, C. L. WAKEFIELD, Dallas. Directory: The officers and W. H. WEISS, San Antonio and GEORGE B. HENDRICKS, Fort Worth.

Next meeting, Galveston, third Wednesday in March, 1896.

PENNSYLVANIA STATE STREET RAILWAY ASSOCIATION.

Next meeting, first Wednesday in September, 1895.

President, JOHN A. RIGG, Reading; First Vice-President, ROBERT E. WRIGHT; Secretary. S. P. LIGHT, Lebanon; Treasurer, W. H. LANIUS, York.

THE MAINE STREET RAILWAY ASSOCIATION.

President, W. R. WOOD, Portland; Secretary and Treasurer, E. A. NEWMAN. Portland; Executive Committee, W. R. WOOD, Portland; GEORGE E. MACOMBER, Augusta; F. M. LAUGHTON, Bangor; FRANK W. DANA, Lewiston; AMOS F. GERALD, Fairfield.

MICHIGAN STATE STREET RAILWAY ASSOCIATION.

President, W. L. JENKS, Port Huron; Vice-President, W. WORTH BEAN, St. Joseph; Secretary and Treasurer, B. S. HANCHETT, JR., Grand Rapids; Executive Committee. the OFFICERS and DAVID H. JEROME, Saginaw. and STRATHERN HENDRIK. Detroit.

THE STREET RAILWAY ASSOCIATION OF THE STATE OF NEW JERSEY.

President, THOS. C. BARR, Newark Vice-President. W. S. SCULL. Camden: Secretary and Treasurer, CHARLES Y. BAMFORD, Trenton; Executive Committee, OFFICERS and C. B. THURSTON, Jersey City; H. ROMAINE, Paterson S. B. DOD, Hoboken.

Winding Clock Company, New York, N. Y. Filed Nov. 15, 1894.

538,777. Electric Watchman's Clock. Otto E. Hausburg, New York, N. Y. Filed April 17, 1894.

538,786. Electric Railway. Henry R. McLean and Gustav A. Kornetzke, Schenectady, N. Y. Filed Aug. 3, 1894.

538,816. Telegraphic Sounder. Jesse H. Bunnell, New York, N. Y. Filed April 19, 1893. Renewed June 21, 1894.

538,819. Current-Motor. John W. Cover, Everett, assignor of one-half to Milton O. Tibbits, Snohomish County, Wash. Filed May 17, 1894.

538,825. Commutator. Jonathan P. B. Fiske, Alliance, Ohio. Filed Feb. 9, 1895.

538,844. Trolley Bar. Clarence Parker and Arthur R. Trepagnier, New Orleans, La. Filed July 13, 1894.

538,857. Motor-Truck. Walter S. Adams, Philadelphia, Pa., assignor to John A. Brill, same place. Filed Nov. 5, 1894.

538,858. Car-Truck. Walter S. Adams, Philadelphia, Pa., assignor to John A. Brill, same place. Filed Feb. 16, 1895.

538,859. Car-Truck. Walter S. Adams, Philadelphia, Pa., assignor to John A. Brill, same place. Filed Feb. 16, 1895.

538,864. Motor-Truck. John A. Brill, Philadelphia, Pa. Filed March 20, 1894.

538,865. Motor-Truck. John A. Brill and Walter S. Adams, Philadelphia, Pa.; said Adams assignor to said Brill. Filed Jan. 3, 1894.

538,871. Electrically-Operated Switch. Henry A. Hartman, Philadelphia, Pa. Filed Jan. 12, 1895.

538,873. Guard for Street-Cars. Henry A. Howe, New York, N. Y., assignor to himself, Joseph Livingston, and Albert H. Gross, same place. Filed Oct. 18, 1894.

538,904. Electrical Connection. James M. Faulkner, Philadelphia, Pa. Filed Feb. 28, 1895.

538,919. Absorptive Material for Storage-Batteries. Edward R. Knowles, Brooklyn, N. Y. Filed Oct. 15, 1891.

538,936. Car-Fender. Louis F. Trinchard, New Orleans, La., assignor of one-third to Frederick Querens, Jr., same place. Filed Jan. 2, 1895.

538,940. Car-Fender. Otto A. Wicke and Philip Reinhart, Brooklyn, N. Y. Filed Oct. 5, 1894.

538,943. Fender, or Life-Saving Attachment for Cars. George W. Archer, Rochester, N. Y., assignor to the Archer Manufacturing Company, same place. Filed Nov. 18, 1893.

538,948. Motor-Truck. John A. Brill and Walter S. Adams, Philadelphia, Pa; said Adams assignor to said Brill. Filed Feb. 17, 1893.

538,963. Automatic Car-Fender. William Hemstreet, Brooklyn, N. Y. Filed Oct 11, 1893.

538,975. Telephone System. James W. McDonough, Chicago, Ill. Filed May 21, 1891.

538,982. Car-Fender. Robert Thomson, Brooklyn, N. Y., assignor of one-fourth to Joseph Norwood, same place. Filed Oct. 12, 1894.

538,999. Electric-Arc Lamp. Samuel S. Allin, London, England. Filed Oct. 29, 1894.

539,000. Electrical Hose-Signaling Apparatus. William Fowler, Colorado Springs, Col. Filed June 20, 1894.

539,017. Electrically-Arranged Hose-Coupling. William Fowler, Colorado Springs, Col. Filed Nov. 30, 1894.

539,019. Electric-Lighting System. Rufus N. Chamberlain, New York, N. Y. Filed Oct. 22, 1894.

ELECTRICAL AGE

Vol. XV., No. 21. NEW YORK, MAY 25, 1895. Whole No. 419

Established 1883.

Entered at New York P. O. as second-class matter, January 18, 1891.

THE ELECTRICAL AGE PUBLISHING CO., Publisher

TERMS OF SUBSCRIPTION:

One Copy, one year,	$3.00
One Copy, six months,	1.50
Great Britain and other Countries,	4.00

Cable Address (all Cables,) "Electage," New York.

W. T. HUNT, President. F. N. BASSETT, Vice-President.

T. R. TALTAVALL, Secretary and Editor.

NEWTON HARRISON, E. E., Scientific Editor.

Canadian Representative, E. W. SAYER, Montreal, Que.

ADDRESS ALL COMMUNICATIONS TO

THE ELECTRICAL AGE PUBLISHING COMPANY,

First Floor, World Building.

NEW YORK.

NEW YORK, MAY 25, 1895.

CONTENTS.

NEW OFFICER'S OF THE INSTITUTE.

At the annual meeting of the American Institute of Electrical Engineers, held on the evening of May 21, the following named officials were elected for the ensuing year: President, Dr. Louis Duncan; Vice-presidents, Prof. M. I. Pupin, W. F. C. Hasson, and Angus S. Hibbard; Managers, Carl Hering, Bion J. Arnold, Dr. Cary T. Hutchinson and Charles F. Scott; Treasurer, George A. Hamilton. This list comprises the straight Council ticket. The Electrical Age extends its congratulations to Dr. Duncan on his election. Under his leadership no doubt the Institute will prosper during the next year. Dr. Duncan's eminence in the scientific world will give the Institute a standing worthy of its character.

PROF. BELL APPEARS AGAINST A SWINDLER.

Prof. Alexander Graham Bell made a special trip to New York a few days ago to appear in court against a swindler named Edgar A. Washburne, who had tried to obtain money on the pretence of being a representative of Prof. Bell. The offender was properly dealt with. Prof. Bell did the community a good service by apprehending the swindler and bringing him to trial.

THE BERLINER DECISION.

The event of the week, of special interest to the electrical world, was the decision in Boston, on May 18, in the Berliner appeal case. The United States Court of Appeals, in the case of the American Bell Telephone Company, et al, appellants, vs. the United States of America, appellee, reversed the decision of the Circuit Court and remanded the case to that court with directions to dismiss the bill. Judge Carpenter of the Circuit Court, it will be remembered, on December 18, last, decided that the Berliner patent, No. 463,569, was invalid, and ordered it to be delivered up for cancellation. From this decision the Bell Company appealed, with the result above stated. According to report the government will now carry the case to the Supreme Court of the United States. In this connection it has been reported that the Berliner patent was rendered invalid by the decision in the Bate refrigerator case, but this is not correct. The last decision revives Berliner's patent, No. 463,569, and unless the Supreme Court decides otherwise the patent will stand for seventeen years after November 17, 1891. This decision is a remarkable document, if document it can be called. It simply states that the decision of the lower court is reversed, but gives no reasons why it is reversed These are promised later on. In the meantime every one will naturally be curious to know by what extraordinary course of reasoning the Court of Appeals upset the verdict of the inferior court. The curiosity arises from the manifest injustice in the case. The decision of Judge Carpenter in killing the patent was regarded as fair and just by all concerned, excepting the Bell Telephone Company. It was based on right and justice, and how the higher court could find grounds upon which to establish the contrary opinion is a profound mystery. Our wavering belief regarding hypnotism has now been firmly set; we now believe in it thoroughly; we believe it is an active force, and we believe the judges of the Court of Appeals must have been under its influence when they rendered this decision. The influence of the Bell Telephone Company is great, but the influence of justice is vastly greater, and there is yet strong hope that the telephone monopoly will be completely wrecked when the Supreme Court of the United States passes upon the merits of the case. Enterprise looks to this court for emancipation from the enervating influence of the Bell monopoly, which seeks to stifle all legitimate enterprise opposed to its own plans. The electrical fraternity have great confidence in the Supreme Court—the great bulwark of right and justice—and feel confident that justice will be accorded in the end.

THE BERLINER PATENT UPHELD.

IMPORTANT DECISION IN BOSTON.

On May 18, in Boston, the United States Circuit Court of Appeals rendered its decision in the case of the American Bell Telephone Company, et al., appellants, vs. the United States of America, appellee. The substance of the order is contained in the following paragraph:

The decision of the Circuit Court is reversed, and the case is remanded to that court with directions to dismiss the bill. Ordered, that the appellees have leave to file their motion as to the form of judgment on clerk's list and also brief in support of the same on or before the 25th instant. The appellants to file brief in reply on or before the 31st instant.

The full text of the opinion will not be made public until June 10.

Judge Carpenter, on December 18, 1894, decided that the Berliner patent was invalid, and ordered it to be delivered up for cancellation. The company appealed, and now the result of this appeal is favorable.

The Berliner patent is No. 463,569, and was issued on November 17, 1891. The instrument covered by it is a device commonly known as a telephonic transmitter.

The United States relied upon two grounds to show that the patent was void. The first was that there was illegal delay in its issue. The second was that a prior patent was granted upon the same application to the same applicant for the same invention. This prior patent referred to was one granted to Berliner in 1880.

The application for the patent in suit was filed June 4, 1877, and a patent was issued November 17, 1891. The ground taken by the government was that the Bell Company intentionally delayed the prosecution of the Berliner application and the issue of the Berliner patent for the purpose and with the result of prolonging its control of the art of telephoning, which would cease with the expiration of the Bell patents in 1893, and that it did this by submitting to delays on the part of the officers of the patent office, which delays the Bell company had in its power to prevent, and refrained from preventing for an unlawful purpose. This conduct was alleged to have constituted a fraud practiced on the public through the commissioner of patents and his assistants. It was claimed that the patents so obtained may and should be annulled by the decree of the court.

The decision of Judge Carpenter sustained the two grounds of attack made by the government against the patent, and held that it was void, and should be delivered up to be cancelled.

The counsel were among the most eminent in the country. Causten Browne, of Boston, and Judge Robert S. Taylor, of Indiana, acted for the government, and W. G. Russell, J. J. Storrow, F. P. Fish and C. H. Swan for the Bell Company. The case was argued before Judge Carpenter for six days in June, 1894, and for four days ending April 19 last, before the Circuit Court of Appeals.

The government had on file a motion to amend the bill, and to allege that in addition to the illegal delay in the prosecution of its application for a patent, the Bell Company had a tacit understanding with the officials of the patent office not to issue the Berliner patent pending the determination of the suits then pending over the Drawbaugh patent, which latter patent was claimed to be an interference.

It is in view of this motion to amend that the Court of Appeals gives the government leave to file its motion as to the form of judgment in this particular case.

The United States will endeavor to have the judgment in this case so framed that it will debar it from going ahead upon the ground it seeks to introduce against the validity of the patent as contained in its action to amend. It is given until May 25 to file its brief as to the form the judgment should take, while the Bell Company is given until May 31 to file its brief upon the same subject.

It is reported that the case will now be carried to the United States Supreme Court.

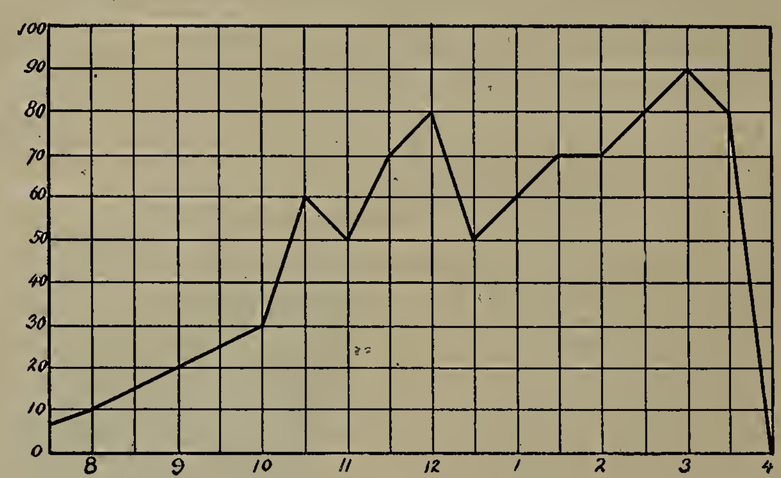
A full description of Berliner's patent, and illustration of the same, will be found on page 292.

CUPID'S CURVES.

A young electrical engineer has hit upon a new application of the "curve" principle. If the values of hysteresis, currents, volts, etc., can be represented graphically by means of curves, he argues, why not carry the idea a little further, and represent the individual emotions. Take a young man in love, for instance. What is simpler than to thus record his tender passions, and refer back to these records to ascertain the course of his love. He would thus be enabled to note his progress towards matrimony, and if the records of today, compared with those of six months or a year ago, showed a substantial increase in warmth, he could tell whether or not he would be justified in propounding the momentous question and settling matters.

This young man is of a practical turn of mind. He calls on his girl frequently, and after he goes home he makes a chart showing the intensity of his love, with all its variations. He calls these records "Cupid's Curves," and he proposes to have them bound so that, after he is married, he and his wife can glance over them and study the various perturbations of the erratic line, first up and then down.

"Charlie," she will say, pointing to a particularly pre-



CUPID'S CURVES.

cipitous tumble on a certain date, "there's where you were mad at me, and didn't love me; do you remember?"

"Yes," Charlie confesses, "but see how much I loved you after we made up again; see how the curve rises!"

We might speculate thus forever, but in order to give our readers an idea of Charlie's beautiful conception, we give herewith one of his "curves," which tells its own story. It covers a period of nine short hours, and on analyzing it, it seems to indicate that the wedding day is not far off.

Let us read it. At 7:30 P. M. Charlie is evidently starting for the house of his adored one. At 8 he has reached the house, and at 10 P. M., after Maude's little brother has been put to bed, and the old folks have retired to their room, the curve takes a sudden upward flight. From that time on until 2 A. M., with the exception of a few intervening spats, the current of love goes higher and higher, and flows with little resistance. At 2 o'clock Charlie prepares to start for home, with the result of a little higher jump, on the thought of separation. At 3 o'clock the final embrace is recorded; at 3:30 Charlie lays down his weary head, and at 4 A. M. his eyes close in sleep.

THE MELAPHONE.—Melaphone is the name of an instrument of western origin, by the use of which it is said that the human voice can be heard a mile. It is an improvement in telephones. A despatch from Cincinnati, O., states that the instrument was tested on a steamboat and that the pilot talked with the agents on shore with great ease. It is of great value to river steamboat traffic.

BERGMANN ALTERNATING ARC LAMPS.

The accompanying illustrations show three styles of Bergmann alternating constant potential arc lamps, for which R. B. Corey, Havemeyer Building, New York, is general sales agent.

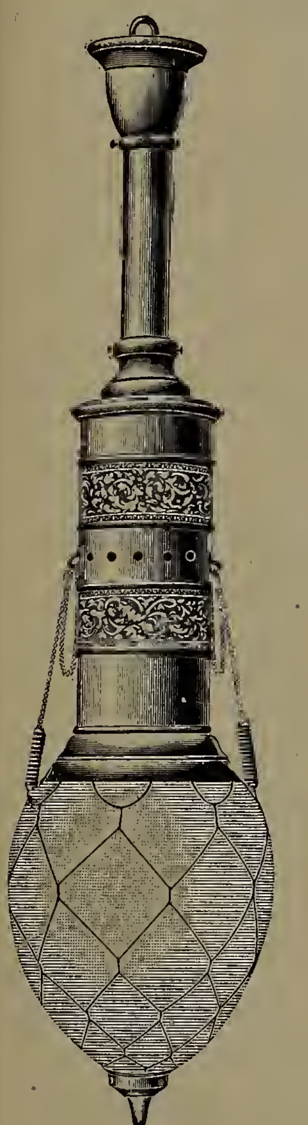
This type of lamp is designed to meet the demand for an economical lamp for use on alternating incandescent circuits. It is first-class in all respects, simple in construction, reliable in action and durable.

The lamps are made in two lengths, the regular and the short length. The former measures 49 inches, and burns 12 hours, and the short lamp 41 inches burning 8 hours. Both operate at 30 to 33 volts and are connected in multiple. Where the voltage of the secondary circuit is about 50 or 100, the lamps are brought down to the proper voltage by the use of economy coils. The regular amperages are 11 and 14.

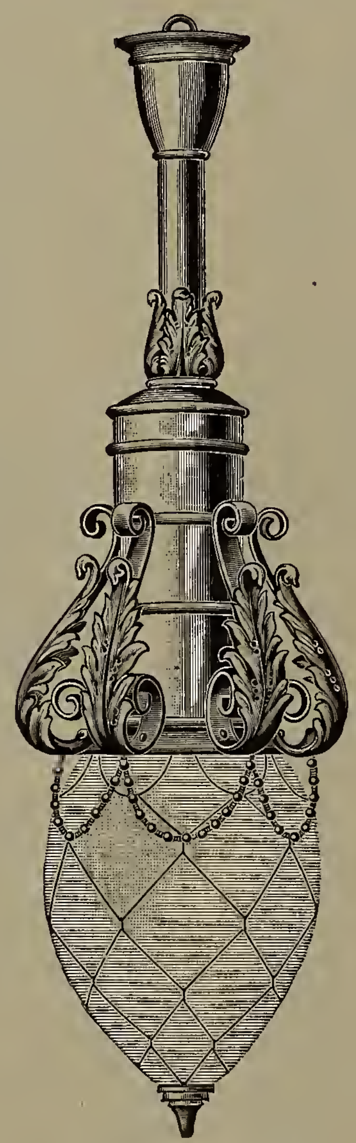
These lamps are finished in polished brass, black and imitation iron. Few parts enter into their construction, therefore they are not liable to derangement. Their regulation is steady, only one solenoid being used, and without any adjustments. The method of suspending and protecting the globe insures safe and quick trimming, and the mechanism is protected by a dust and weather-proof covering. The lamp makes its arc with less than the normal rated current, and regulates perfectly with no waste of current in resistance on 30 to 33 volt circuits.

The carbon holders are of the latest design and adjustable, so that carbons of any size may be used.

Mr. Corey also handles carbons of all sizes for both direct and alternating current arc lamps. These goods are of the celebrated Nurnberg make, and are of the highest grade. Soft cored carbons for alternating work come in 20 different sizes. For direct current lamps, soft cored uppers are of 12 sizes, and solid lowers the same.



BERGMANN LAMP.



BERGMANN LAMP.

BERGMANN LAMP.

Personal.—Mr. M. D. Law, of the Love underground conduit railway system, Washington, D. C., gave the Electrical Age a call last week. New Yorkers will hear more about Mr. Law very soon.

A HISTORY OF THE TELEPHONE.*

BY W. CLYDE JONES.

Bell preceived the mathematical requisite for the transmission of speech before he had conceived the means for embodying it in material form. Sir William Thomson, now Lord Kelvin, commenting upon this achievement of Bell, remarked: "We can but admire the hardihood of invention that conceived such very slight means to realize the mathematical conception, that, if electricity is to convey all the delicacies of quality which distinguish articulate speech, the strength of the current must vary continuously, as nearly as may be, in simple proportion to the velocity of a particle of air engaged in constituting the sound."

On the day that Bell filed his application for a patent, Elisha Gray filed a conveat in which he showed means for varying the resistance of the circuit to produce the undulatory current. He provided upon the diaphragm a needle which dipped into a cup of acidulated water, and, as the diaphragm vibrated, the needle was caused to approach or recede from an opposed circuit terminal, varying the resistance of the circuit. Bell in his patent specification, had likewise suggested the employment of means for varying the resistance of the circuit in the production of the undulatory current, and his first successful transmission of speech was accomplished with an instrument embodying this principle. The development of transmitting instruments has been made along this line, while the magneto telephone has been universally employed as a receiving instrument. To Berliner is attributed the invention of a resistance-varying telephone, comprising solid electrodes continuously in contact, the varying resistance being accomplished by varying the pressure of contact of the electrodes by the vibration of the diaphragm. Edison conceived the employment of carbon for electrodes, while Blake suggested the mounting of the electrodes individually upon springs, in a manner to prevent the breaking of the circuit. The transmiter has been improved by

* *Cassier's Magazine*, May, 1895.

Hunnings by using granular carbon between a stationary plate and the vibrating diaphragm thus securing a greater variation of resistance for a given movement of the diaphragm. The Hunnings transmitter, with improvements for preventing the caking of the granular material, marks the highest stage of development of the telephone transmitter.

THE BERLINER PATENT.

Following is a copy of the specifications and claims of the letters-patent No. 463,569 issued to Emile Berliner on November 17, 1891, on a "Combined Telegraph and Telephone," which patent was revived by the decision of the Court of Appeals in Boston on May 18, last.

PATENT NO. 463,569, DATED NOVEMBER 17, 1891.

COMBINED TELEGRAPH AND TELEPHONE.

Application filed June 4, 1877.

To all whom it may concern :

Be it known that I, EMILE BERLINER, in Washington, in the District of Columbia, have invented a new and useful improvement in combined telegraph and telephone, of which the following is a specification :

My invention consists in a new and useful improvement in transmitters for electrically transmitting sound of any kind, of which the following is a specification.

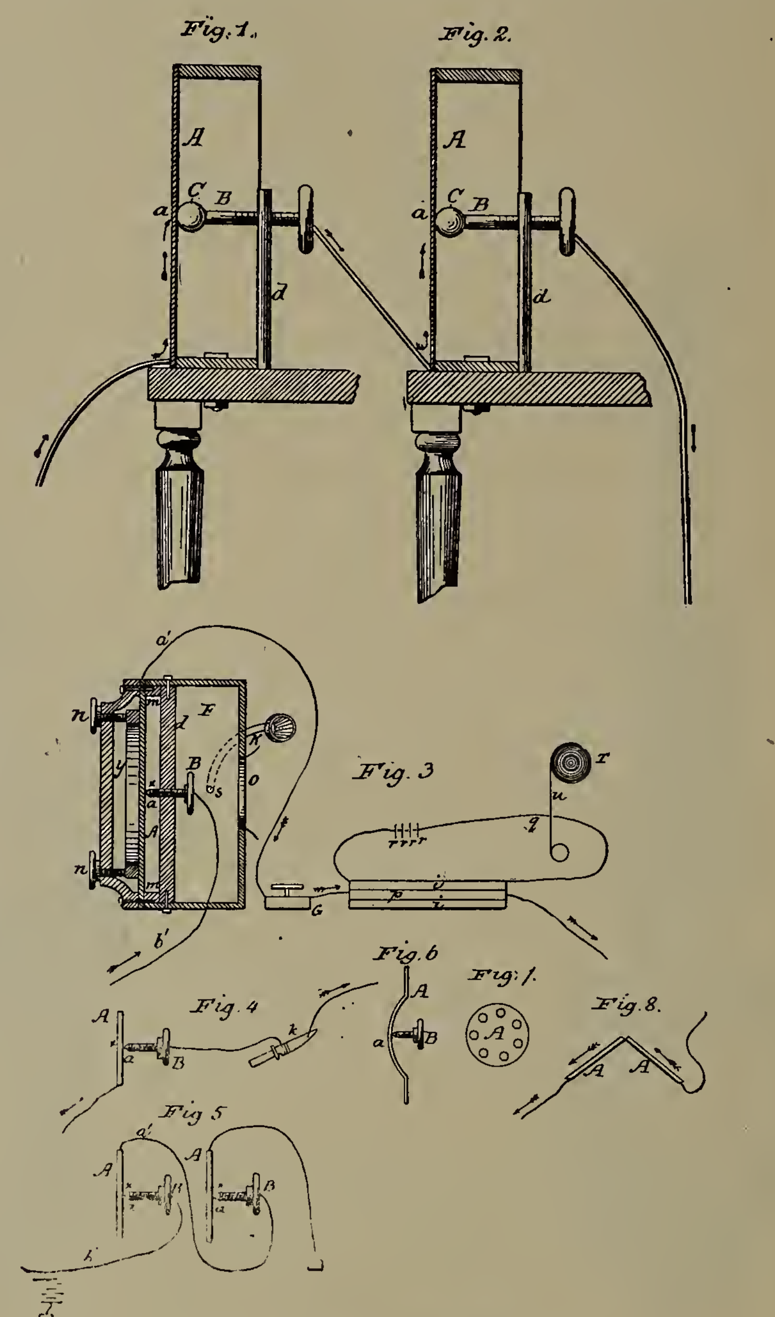
It is a fact that if at a point of contact between two conductors forming part of an electric circuit and carrying an electric current the pressure between both sides of the contact becomes weakened the current passing becomes less intense—as, for instance, if an operator on a Morse instrument does not press down the key with a certain firmness the sounder at the receiving instrument works much weaker than if the full pressure of the hand had been used. Based on this fact I have constructed a simple apparatus for transmitting sound along a line of an electric current in the following manner.

In Figures 1 and 2 of the drawings, A is a metal plate well fastened to the wooden box or frame, but able to vibrate if sound is uttered against it or in the neighborhood of said plate. Against the plate and touching it is the metal ball C, terminating the screw-threaded rod B, which is supported by the bar or stand *d*. The pressure of the ball C against the plate A can be regulated by turning the rod B. The said ball and plate are included in circuit with an electric battery, so that they form electrodes, the current passing from one of them to the other. By making the plate vibrate the pressure at the point of contact *a* becomes weaker or stronger as often as vibrations occur, and the strength of the current is thereby varied accordingly, as already described. By placing now, as is shown in the drawings, one such instrument in the station, Fig. 1, and another instrument capable of acting as a telephonic receiver in the station, Fig. 2, both situated on the same electric circuit in which a current is passing (as shown by the wire connections following the arrows), sound uttered against the plate of the instrument, Fig. 1, will be reproduced by the plate of the instrument, Fig. 2, for as the vibrations of the transmitter, Fig. 1, caused by the sound will alternately weaken and strengthen the current as many times as vibrations occur, the diaphragm of the receiver will be caused by these electrical variations to vibrate at the same rate and measure. The latter vibrations being communicated to the surrounding air, the same kind of sound as uttered against the transmitter, Fig. 1, will be reproduced at the receiver, Fig. 2, or in as many other receiving instruments as are situated within the same electric circuit.

It is not essential that the plate should be of metal. It can be of any material able to vibrate, if only at the point of contact suitable arrangement is made so that the current passes through that point. The plate may be of any shape or size, or other suitable vibratory media may be used—a wire, for example. Any other metallic point, surface, wire, etc., may be substituted for the ball. There may be more than one point of contact to be affected by the same vibrations. Both of the electrodes may vibrate, although it is preferable that only one should. If the uttered sound is so strong that its vibrations will cause a breaking of the current at the point of contact in the transmitter, then the result at the receiving instrument will be a tone much louder, but not as distinct in regard to articulation.

I have also embodied my invention in and used it in connection with some other forms of apparatus.

In the drawings, Fig. 4 represents a detached view of the vibratory diaphragm, showing its relative situation to the poles of the galvanic current. Fig. 3 represents a



THE BERLINER TRANSMITTER.

view of a complete apparatus ; Fig. 5, a view of the diaphragms arranged to receive and transmit the sound waves ; and Figs. 6, 7 and 8, modifications of the vibratory diaphragm.

In the drawings the letter A represents a diaphragm or plate of thin metal of limited conductive capacity, such as iron, steel, German silver, platinum, secured in the frame *m m* in the box F in any convenient manner.

The letter *y* represents a ring resting against one side of said diaphragm and capable of being made to bear upon the same with more or less force by means of set-screws, *n*, in order that the tension of the diaphragm may be regulated.

The letter B represents a screw or pin of metal, pointed at one end and mounted in a cross-piece, *d*, in such position that the point will be in contact with the diaphragm A. The diaphragm A is connected with one pole of a battery by means of a wire, *a′*, and the pin or screw, B, with the other pole by means of a wire, *b′*.

The box F of Fig. 3 is provided with a tube K, to which the ear of the operator may be applied, in order to hear the sounds produced by the vibratory diaphragm when the in-

strument is employed as a receiver, and a tube O, through which he can speak when employing the instrument as a transmitter, so that the operator is not in need of moving the instrument or moving his head while carrying on a conversation.

Instead of employing a single vibratory plate, as shown in Figs. 1, 2, 3, 4 and 5, in each instrument, two such plates may be employed, as illustrated in Fig. 8, said diaphragms being connected to the respective poles and in contact with each other at their edges, as shown in Fig. 8.

The diaphragm of my improved receiver or the diaphragm of any magneto-receiver (such as those described by Alexander Graham Bell in his patent No. 174,465, of March 7, 1876, and in his patent No. 186,787, of January 30, 1877), will receive a particularly strong shock at the setting in and sudden cessation of the current when a ticking sound will be heard from the plate; but a weakening of the current alone can also be observed most distinctly and accurately by making, for example, a connection within the same circuit by a wire and the blade of a knife *k*, Fig. 4. When scraping the wire end over the blade of the knife, this scraping is distinctly audible on the plate. Here the current is never entirely interrupted, yet the minute elevations and cavities on the blade, caused by the structure of the steel, and which again cause minute alterations in the intensity of the current, are sufficient to shake or vibrate the plate with varying intensity, thus rendering again the same peculiar scraping noise. If, now, the plate of one instrument, as in Figs. 1 or 5, is vibrated by sound waves (which happens whenever any kind of sound is uttered or is produced by musical instruments in its neighborhood) every wave or vibration that strikes the plate produces between the two sides of the contact a variation of pressure, which causes a variation of resistance at that point, and therefore a variation in the strength of the passing current, and if the sound is sufficiently strong it will break the circuit at said point of contact, the variations in the current thus produced causing similar vibrations in the plate of the receiving instrument. The essential part of the apparatus is the point of contact, which must offer a resistance to the current.

It is not necessary in the transmitting apparatus that the plate should be of conducting material, for any substance capable of vibration will answer, if only at the point of contact provision is made for the current to pass. It is sometimes convenient to use a vibrating plate in the form of a reflector, as shown in Fig. 6, for concentrating the sound, or the diaphragm may be provided with a number of apertures to disperse the sound, as shown in Fig. 7. These apertures prove advantageous with strong sounds, particularly the hissing sounds, as while the sound-waves are rushing toward the diaphragm, those touching the plate are repelled and partially destroy the following waves, just as sea waves when forced against a cliff will be thrown back, destroying those directly behind. The holes permit most of the waves to pass to the other side of the plate, making the vibration of the plate more perfect and even.

I will here describe a recording apparatus, which, however, I do not claim.

In Fig. 3, G is a galvanometer, which is located in circuit with the contact-pieces or electrodes A B, and which serves as a convenient means for ascertaining the adjustment of the contact-pieces of the transmitter, so that a current shall pass. *i p i* is a Ruhmkorff coil or induction apparatus. When a current passes through the primary coil *p* and suddenly is broken, a spark will rush over between the ends of the secondary coil *i i* at *q*. This spark is accompanied by a peculiar sound due to the electric discharge, and if we bring between the ends of the secondary the connecting points *r*, *r*, *r*, *r*, a spark will occur between each of them, provided they are near enough to each other, and the peculiar sound will be heard between each of them. I now arrange a strip of chemically-prepared paper or other substance, *n*, to be drawn by clockwork, T, between the ends of this secondary wire at *q*. Said strip can be prepared in such a way that each spark will produce a mark upon it. If, therefore, the plate A vibrates by sound, each vibration causing a break of contact will produce a spark at *q*, and the strip being drawn through, a succession of marks will be produced upon the strip according to the number of vibrations caused by the sound; but at the same time the sound which was uttered at the plate A will be heard from the sparks rushing over the points *r*, *r*, *r*, *r*, and *q*, because every spark produces one wave in the atmosphere in which it occurs, and a certain number of waves will therefore produce certain tones. Therefore, the same sound which is uttered against the plate A will be heard from the sparks. The scraping of the wire end on the knife-blade, *k*, as in Fig. 4, in the primary current will also be heard between the wire ends of the secondary current at *r*, *r*, *r*, *r*, and *q*. This permits a number of designs for a receiving apparatus within the secondary current. For instance, initials, ornaments, etc., consisting of a number of metal pins can be constructed in such a way that whenever a tone is produced against the plate A a spark will rush over said metal pins, and at the same time their sound is produced will render the design visible in illuminated characters.

By making the person of the operator a part of the secondary circuit and discharging the sparks in the body in the neighborhood of the ear the sound will be more particularly apparent.

It will be observed that in Figs. 1 and 2 one of the electrodes presents a convex curvilinear surface like a rounded knob. This possesses some advantages, among which are ease of construction and durability, because it does not wear away the opposing electrode as much as a sharp one would, and when the contact with the vibrating body is made of such a form the freedom of the vibration is less interfered with.

I do not claim that I am the first inventor of the art of transmitting vocal and other sounds telegraphically by causing electrical undulations similar in form to the sound waves accompanying said sounds. Neither do I claim that I am the first who caused such electrical undulations by varying the resistance of an electric circuit in which a current was passing.

I do not herein claim the novel form of vibratory-plate receiver which I have described, because that is a subject of claim in another application.

I claim—

1. The method of producing in a circuit electrical undulations similar in form to sound waves by causing the sound waves to vary the pressure between electrodes in constant contact so as to strengthen and weaken the contact and thereby increase and diminish the resistance of the circuit, substantially as described.

2. An electric speaking-telephone transmitter operated by sound waves and consisting of a plate sensitive to said sound waves, electrodes in constant contact with each other and forming part of a circuit which includes a battery or other source of electric energy and adapted to increase and decrease the resistance of the electric circuit by the variation in pressure between them caused by the vibrational movement of said sensitive plate.

3. The combination, with the diaphragm and vibratory electrode, of a rigidly-held opposing electrode in constant contact with the vibratory electrode, substantially as described.

4. In a telephonic transmitter, a vibrational plate made concave for condensing the sound, substantially as set forth.

5. In a telephonic transmitter, a vibrational plate provided with one or more apertures, as and for the purposes set forth.

6. A speaking-telephone transmitter comprising a diaphragm or disk sensitive to sound waves, combined with a rigidly-held but adjustable electrode in contact with the same, whereby the electric current is transformed into a series of undulations corresponding with the vibrations of said diaphragm.

—Alternating current machines are frequently, and large constant current machines in central stations are occasionally separately excited.

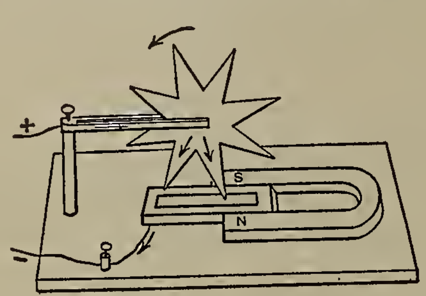
PRINCIPLES OF DYNAMO DESIGN.

BY

Newton Harrison E.E.

(*Continued from Page 281.*)

Barlow's wheel, which was the first machine to transform electrical into mechanical energy, dates back from very early days. In this machine, the simple principle, by virtue of which an attraction exists between a magnetic field and an electric current, is very clearly demonstrated. Both this wheel and Faraday's disk dynamo differ essentially



BARLOW'S WHEEL.

in no respect. As the illustration indicates, a circular metallic wheel dips into a trough of mercury and lies between the poles of a magnet, so that if current be applied to the trough and the axis of the wheel, the reaction between the current and field will be strongly illustrated by the actual rotation of the wheel, by a rapidity of motion that in certain cases would become exceedingly high.

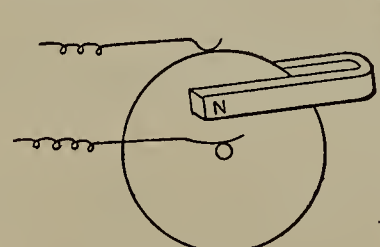
On the contrary, if the Faraday disk be revolved, with connections applied as shown in the illustration, an electromotive force will be produced proportional to the speed of rotation and to the strength of field. The constituent elements which collectively tend to build up the difference of potential between the poles of a machine are therefore included in this exceedingly primitive type of machine. With a given number of lines of force, a known velocity per second and a number of wires or inductors to cut the lines of force, an E.M.F. is produced of a value that can be accurately determined by the following formula:

$$E.M.F. = \frac{\text{revs. per second} \times \text{total number of lines of force} \times \text{inductors}}{100,000,000},$$

or as it is generally written

$$E = \frac{n\,C\,N}{10^8}$$

There are a strange variety of cases in which it is necessary to carefully consider the conductors cutting the lines

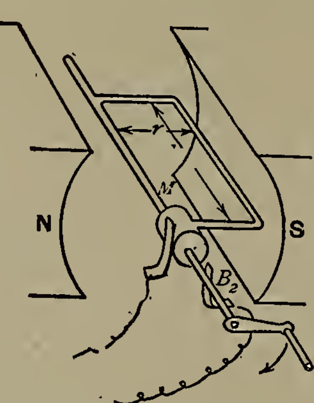


FARADAY'S DISK DYNAMO.

of force, both as regards the number of times per second or frequency and the exact number of conductors. The case that is best to consider from an elementary standpoint is that of a single turn of wire revolving in a magnetic field. The disk dynamo is practically a machine of this class, that is to say; with a single turn of wire on the armature.

To produce an E.M.F. of an appreciable value in this type would necessitate a very high speed, because but one turn is cutting the lines of force. Therefore in order to produce one volt we would need a field of one hundred million lines of force and one movement through them per second. The conductors and speed with a fixed field can be adjusted in various ways so as to produce either a high or low pressure or a large or small current. With a single line of force and one turn, or more properly speaking one inductor, a velocity of one hundred million vibrations per second would be required for the production of one volt.

Perhaps more than is at present expected will be soon achieved in that direction as it is possible to oscillate, through a small distance, a coil without very considerable difficulty at enormous rates of speed, and with a powerful magnetic field induce very high pressures in the coils. Nikola Tesla has been performing remarkable experiments in that direction with evident success. Thus the original and simple system of employing a coil of a known number of turns and a definite field brings us back to perhaps the earliest experiments of Faraday in this direction. With a single turn revolving round a shaft there is a rise and fall of pressure and with each perfect decrease a complete reversal of direction. When the coil is in the position as shown in the illustration, with but the slightest movement of the wire the greatest possible number of lines of force are cut, while a position at right angles to it would mean that wherein the least number of lines of force are cut with a given amount of motion. We are therefore confronted



SIMPLE DYNAMO.

with the necessity of carefully examining the conditions governing the maximum and minimum flow and the exact points at which reversals occur. With these facts clearly understood a most comprehensive view can be taken, not only of any special case but of those involving complications that would forbid a clear insight unless such rules be rigidly adhered to in each particular application.

In general, they may may be investigated as follows:

A coil approaching a north pole
" " leaving "
" " approaching a south "
" " leaving " "

and in the above cases the field may be uniform at all points or of a changeable character; that is to say, not uniform.

(*To be continued*).

LECTURE ON INDUCTION. — Mr. Nelson W. Perry gave a lecture on "Induction," before the Brooklyn Electrical Society, at the Edison Assembly Rooms, 360 Pearl street, Brooklyn, N. Y., on the night of May 14.

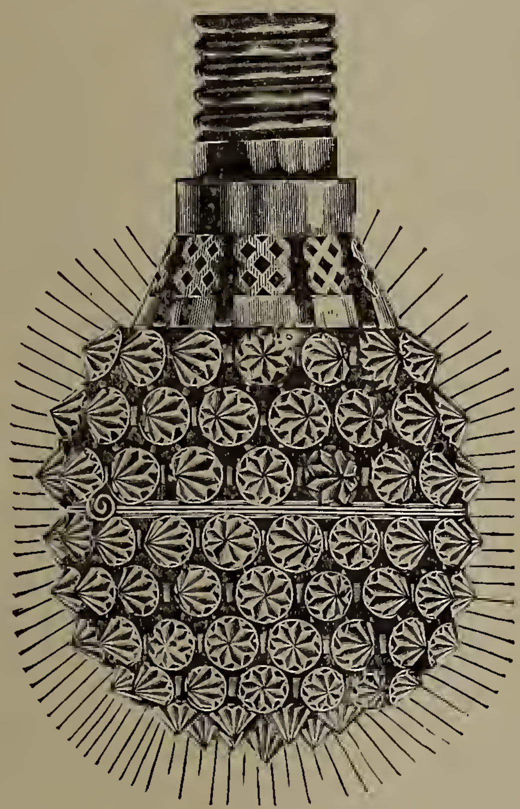
TEMPERATURE OF INCANDESCENT FILAMENTS. — Prof. Weber has lately given the results of a number of experiments made by him to determine the temperatures of filaments in electric incandescent lamps. He has found that the normal temperatures of all species of incandescent lamps is approximately the same, and is comprised between 1,565° and 1,588° C. In the case of some lamps giving a very brilliant light—that is to say, with very thick filaments—the temperature is forty degrees higher.

—"Don't never prophesy unless you know."—*Hosea Bigelow.*

—The work of exhausting the air from incandescent lamp bulbs has reached such perfection that in the completed lamp less than one-millionth, or sometimes one ten-millionth part of the original quantity of air remains.

THE SPITZER.

A very brilliant and attractive article of decoration for incandescent lamps is the Spitzer, illustrated herewith. The Spitzer is a jewelled cover made to fit 16-candle power bulbs. It can be attached to the lamp in a moment, and for adornment in theatres, hotels, cafés, jewelry stores,



THE SPITZER.

show windows, etc., there is nothing to equal it. The light is broken into thousands of little brilliant scintillations, which do not weary the eye as the bare light does, and yet none of the light is lost to useful purposes.

L. D. Hatton & Co., No. 11 Warren street, New York, handle this excellent little specialty, and are finding a ready demand for it. They own the dies and moulds, and can make emblems or figures in any size or form, and in any desired color.

ELECTRIC HEAT-ALARM FOR JOURNALS.

Fires in factories and mills frequently start in a hot bearing, and the surrounding conditions in these places

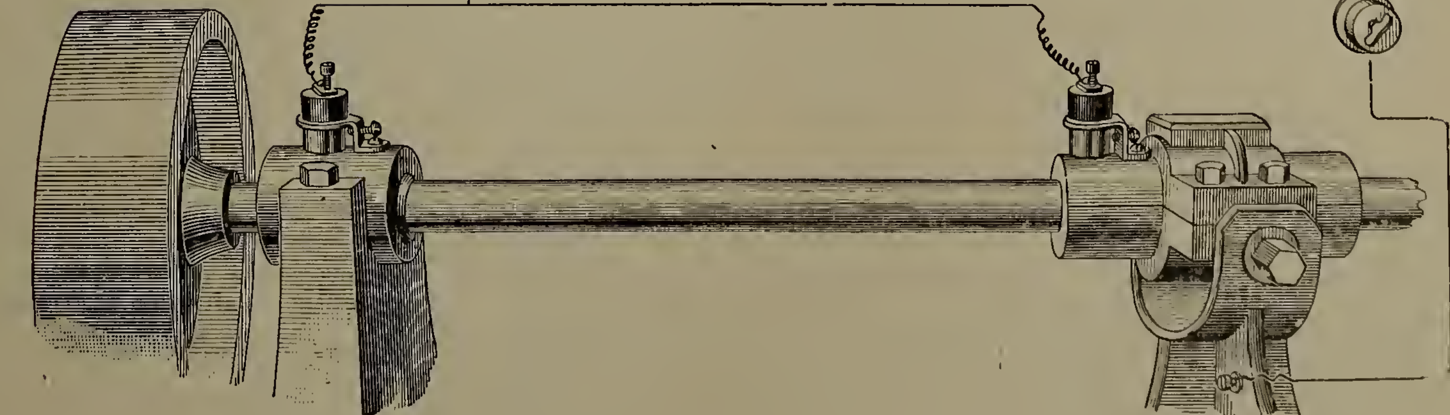


FIG. 1.

are usually of such character as to favor the rapid spead of the flames. Three or four weeks ago a serious fire occurred in Moretown, Vt., it having originated in a hot bearing in a large steam saw-mill, and before it was finally subdued a large amount of property was consumed.

Various devices have been invented to prevent the starting of fires in this manner, but most of them fail to do their duty at the time they are most depended upon to act, and the result is ruin. The system that has survived the test of time and met with every demand in practice, however,

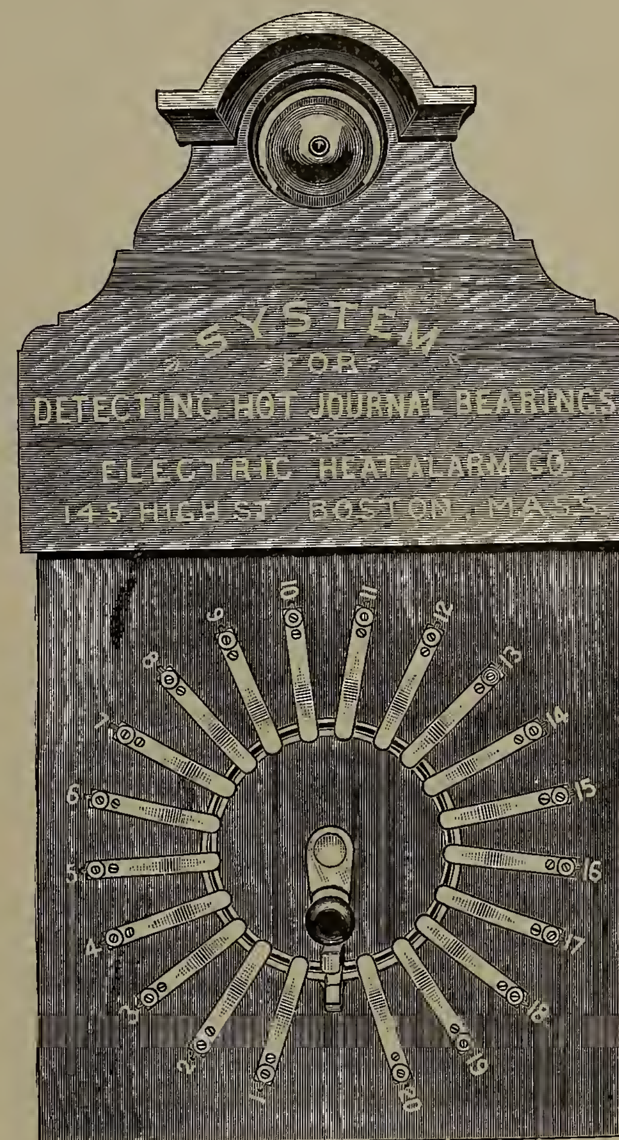


FIG. 2.

is that of the Electric Heat Alarm Co., of Boston.

This company claims to have the only practical journal alarm in the market. The particular part of its system which we call attention to at this time is that designed for giving an audible alarm when a journal has become overheated.

The essential element in the system is, of course, the

thermostat. This instrument is constructed on scientific principles, and is adjustable as regards the limit of temperature allowable. The contact points and surfaces are hermetically sealed, so as to avoid any difficulty incident to oxidation.

Fig. 1 shows the application of the thermostats to journals and the electric circuit of the system.

When a journal becomes overheated the mercury in the thermostat rises in the cup, and on reaching the wire terminal closes the circuit through the battery, bell, switch and back to the journal through the metal itself.

If thermostats are placed on several shafts, the latter are numbered and electrically connected with corresponding numbers on a switchboard (Fig. 2.) If the journal on shaft 6, for instance, should become overheated and sound an alarm the engineer turns the lever, but the bell will continue ringing until contact is made by the lever with spring 6, thus indicating exactly the location of the trouble.

The value of this system is recognized and acknowledged, and several of the largest mills in various parts of the country are equipped with the device. In the West the inspector of the fire underwriters, after a careful examination of the apparatus, recommended a reduction in rates on mills using this alarm system.

The Electric Heat-Alarm Company's system, obviously, can be applied wherever it is possible for overheating to occur.

Other applications of the system are as automatic fire alarm, hotel call and fire alarm, automatic alarm for grain elevators, coal bunkers, warehouses, etc., etc. It was the only system shown at the World's Fair in a practical manner, and the exhibit excited much favorable comment.

NEW PUBLICATIONS.

Practical Science is the name of a new publication which has just made its May appearance. The May number is the first, and although the usual introductory explanation for its appearance is conspicuous by its absence, we infer that the work is to be published monthly. *Practical Science* is a small size, being 4½ inches wide × 6½ inches long. It is well printed and illustrated. The May number is devoted entirely to the subject of "Lightning Arresters and why they Sometimes Fail." Mr. Alexander Wurts is the author, and no one is better capable to handle the subject than he. The work is "published under the supervision of practical engineers," but it gives no inkling as to who are the editors and who publishes the book. Inasmuch as the advertising pages are monopolized by the Westinghouse Electric and Manufacturing Company, it is reasonable to assume that that concern is the father of this literary enterprise. *Practical Science* is devoted to the practical application of scientific electrical research. If it is conducted on these lines it should meet with favor. The price is $5 per year, or 50 cents a copy.

Electricity in Medicine.—We have received a copy of a pamphlet on "Electricity in Medicine from a Modern Standpoint," by William James Morton, M. D., New York. The matter is reprinted from the *New York Medical Journal* and is full of interest to all intelligent people. The pamphlet is copyrighted by D. Appleton and Company, New York.

THE AMERICAN STREET RAILWAY ASSOCIATION.

At a meeting of the American Street Railway Association held at the Waldorf Hotel, New York, May 15, 16 and 17, there were so many candidates for the position of secretary, which position was made vacant by the recent death of Wm. J. Richardson, that it was decided to refer the subject of appointing a new secretary to the general meeting which will be held in Montreal next October. Col. Partridge, president of the Brooklyn and Newtown R. R. Co., Brooklyn, N. Y., was, however, appointed to look after the association's finances, and the duty of attending to correspondence was placed in the hands of the secretary of the late Mr. Richardson.

The executive committee will soon complete arrangements for hotel accommodations and exhibits at Montreal.

UNDERWRITERS' RULES.

(*Continued from Page 270.*)

Mr. Mailloux:—There are one or two facts in connection with the matter which I think it might be well to bring to the attention of the meeting and which may serve to stimulate discussion. In the first place I would like to call attention to the fact that the insurance companies themselves are not entirely satisfied with the way the matter has been arranged, and at present out of some forty or fifty insurance companies represented in New York city, there are nearly one-half who have formed a little insurance inspection association of their own; they are no longer satisfied with the inspection made by the official underwriters, but have an inspector of their own. I am very sorry that their inspector is not here this evening, as he is a member of the Institute and could give us some very interesting information. I trust that he may have an opportunity at another meeting to give us his experience which is, I assure you, quite interesting.

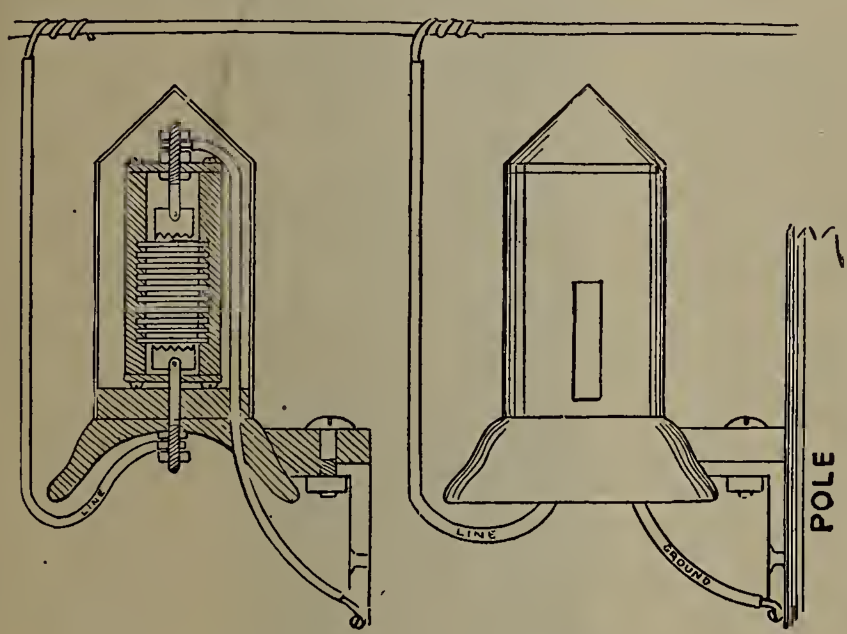
Gentlemen, I feel quite strongly in this matter, because I have had a great deal of experience with the insurance inspectors, not only in this but in various districts, and as Mr. Jenks has very well observed, I found a noticeable difference, of which I will give you one instance. The iron conduit tube was adopted by the New England Insurance Exchange in June last. I had occasion to communicate with them with reference to a large installation at Newport which was in their district. I had found that their rules would not allow me to use an iron conduit, although there were certain electrical and other objections to any other forms of conduit which might be allowed under the rules. I stated the case, urging the electrical objections and the mechanical ones as well, and received a reply the next day stating that the objections were well taken, that they had been submitted shortly before by others, and that it had been decided to allow the iron conduit tube to be used with twin conductors for such cases. Some four or five months afterwards I had occasion, in connection with several installations contemplated in New York city, to go over the same matter. A question came up almost similarly. I went in person to consult with the officials of the inspection department in New York and was informed by them that they had as yet taken no action in regard to the iron conduit tube; expressing at the same time grave doubts as to the propriety of their taking any action whatever. It seemed to them to be something that was of very doubtful, if any, utility, if not absolutely bad. However, in the same breath almost, I learned that the Attix tube, so called, was then allowed. This was several months before any official promulgation of this "Attix" rule was made, as this conference took place some time in October or November. You can scarcely imagine the feeling with which I heard this announcement. I scarcely could believe that we were in a metropolis and in a progressive age when I heard that we were going to be relegated by official direction back to methods which I, for one, should not sanction. I will state that, as a member of the examining board, of this Institute, I would not want to acknowledge or accept as a member, a man who was capable of admitting Attix wire as the rule prescribes. I would consider that he was doing something derogatory to the profession. Although we are still far away from the ideal and the perfect, we who have had practical experience with the different ways of interior wiring, consider the iron conduit tube such a great step in advance that we hailed it with a certain degree of delight, but we were literally told that we must not touch that. Now I submit that when we reach such a point, that the progress of our profession is retarded by arbitrary methods such as these, it is time for us to act. I will give you another case which is quite interesting.

(*To be Continued.*)

UNIVERSAL LIGHTNING ARRESTER.

This arrester is non-arcing and designed for electric railway and central station work. It combines all the successful principles and material construction of a positive arrester. It allows the static charge to pass fully to earth and at the same time proves an effectual barrier to the passage of the dynamo current.

The Universal arrester automatically filters the lightning from the dynamo current during the most severe electrical storms without interruption to business. It is extremely simple in construction, has no moving parts, needs no attention, and will operate in any position. The principles of and combination of high resisting and non-arcing materials which this arrester embodies preclude the possibility of the dynamo current following the lightning discharge. This device, therefore, offers reliable protection to the station or apparatus, and experience has proved it to be



UNIVERSAL LIGHTNING ARRESTER.

one of the most effective lightning arresters in the market. Mr. Harry M. Shaw, 136 Liberty street, New York, is the manufacturer of this excellent device.

KINGDON'S UNDERGROUND MAIN SYSTEM.

Mr. J. A. Kingdon, of London, Eng., is the inventor of a system of laying electric mains underground which has received considerable attention in that country. The *Electrical Engineer*, of London, refers to the system as follows:

Systems of electric mains in which the conductors, whether insulated or bare, are drawn into iron or other pipes or laid in conduits, are open to the objection that an empty space is left round the cables or conductors, where an explosive mixture of air and gas may accumulate. Armored cables are not open to this objection, but as the armoring can be easily penetrated by a pick, additional protection is necessary. In the Kingdon system of laying electric mains these difficulties are overcome in a simple manner. The conductor, insulated with india-rubber, paper, or other material, is thoroughly protected against mechanical injury by an iron or steel channel of U-shaped section placed above the cable. The peculiar form of the exterior of the channel causes a pick or other tool to glance off to one side without penetrating the iron. The interior of the channel is of such shape as to approximately fit the cable. Below the cable is placed a strip of iron or wood, which is moulded to fit the cable. This is forced upwards within the channel, so that it is not liable to displacement or injury. Joints in the channel are covered by means of iron sleeves or slips, which serve also to secure the strip in place. For continuous currents a single-stranded cable may be employed. For alternating currents, two cables laid side by side, or a concentric cable, are used. Concentric or triple-concentric cables are also employed in the case of two or three-wire continuous concurrent systems. Where branches from the mains are required cast-iron junction boxes are inserted, which are filled with solid insulating material after the joints are made and insulated. Where a branch is not immediately but may subsequently be required, a short length of channel is placed, which can be easily removed by driving back the sleeves at either end for the substitution of a junction box. Bends can easily be arranged for places where the cables have to pass round corners or to dip downwards so as to avoid obstruction.

THE WORLD'S PROGRESS.

The world has made greater progress in the last century than in all the earlier ages. This progress it owes to the inventor, the mechanic and the engineer. Modern material advancement practically dates from the time of the general recognition of the inventor's rights, and the formulation of the first rough outlines of our modern system of patent law, at the commencement of the seventeenth century. But all progress is an acceleration, and, slow at first, it becomes increasingly rapid until, after a time, all the world is astounded by its mighty rush. Prof. R. H. Thurston.

THE NEW SCIENCE OF ELECTRIC HEATING.*

BY W. S. HADAWAY, JR.

In developing electric central stations the desirability of a large load factor is apparent. With full knowledge of the requirements in various cases, data on electric cooking and heating have been patiently and carefully collaborated. The result entirely confirms theoretical deductions as to the extent to which the central station can provide at a profit the energy for cooking and heating. There is no doubt that the central station can furnish at a profit the high potential factor in the thermal system. The question now rests as to whether the customer or householder will find a divided heat supply desirable. Of the six parts used, the electric central station can provide one-sixth, the high temperature part, the customer himself burning coal, or gas, to furnish five-sixths of the heat. The electric central station can operate electrically-heated chafing-dishes, and pots for five-o'clock teas (replacing the alcohol lamp), curling irons, plate-warmer in the pantry, laundry irons, small water heater for nursery, bath and dressing-room warmer, etc., and these specialties can all be made to increase revenue without adding materially to the construction account. At a five per cent. rate per h. p. h. the devices enumerated are perfectly practicable, and other specialties, like shaving mugs, toddy heaters, egg-boilers, hot plates, etc., are coming into use. These are all of value as a souce of revenue to the electric central station and of convenience to the users, but it must be doubted whether, with so small a percentage of residence lighting as is now connected, and with the inability to offer but a partial heat supply when connected, electric heating apparatus, in which the heat is derived from simple resistance, will entirely provide the balance in the load sought for.

To illustrate the capacity of an electric station as a heat-producer we may compare the prices charged by the New York Steam Co. and the Edison Electric Illuminating Co. of New York, both operating in the same district and supplying steam and electricity respectively. Using the figures given by Dr. C. E. Emery as the basis of charges for the Steam Company, we find that it furnishes heat to large consumers at 40 cents per 1,000 kals, the kal being the equivalent of 1110 thermal units. For 40 cents 1,110,000 heat units are supplied. Taking the Edison Company's rates, and using the 50 per cent. discount as the rate to a large user, 40 cents will purchase eight h. p. h., or 20,518 thermal units. The ratio between the two is nearly 54 to 1, or, as a loss must be figured in the case of steam, depended upon the temperature at which the condensed

* *Engineering Magazine*, May, 1895.

water is allowed to escape, practically 50 to 1. It would be unjust to leave the figures on the mere heating equivalent of the two forms of energy, as high potential heat energy is almost universally secured by localizing a small proportion of fuel energy and allowing the rest to escape, and is consequently worth more per heat unit, but even were we to admit as a reasonable charge five times as much for high potential heat as for low potential heat the ratio is still 10 to 1, and indicates what might be accomplished could the two plants be run conjointly for a multi-potential heat supply.

* * * * *

The economy of electricity as a thermal agent in cooking is not doubtful, provided the uses to which the various forms of heat supply are put are proportioned in accordance with their heat equivalents limiting electricity to high temperature work in combination with steam both live and exhaust, there appears to be no reason why hotels and public institutions operating their own plants so as to secure a multi-potential system should not employ electricity in cooking very extensively, solely for the purpose of economy, for electricity in a well-designed isolated plant costs much less than four cents per h. p. h., especially if we utilize the by-products of its generation in useful work, as would be the case in a complete thermal system. Ethical considerations in connection with electric cooking are of value after the economy and simplicity of the apparatus are established. Cleanliness, localization of heat at predetermined temperatures, and coolness of the kitchen are important factors in connection with the servant problem. The use of electric cooking apparatus in cooking schools is important, as constant temperatures are easily produced over extended periods.

In industrial work the applications of electric heating are rapidly multiplying. Nearly every manufactory of size has its own electric plant, and can secure electricity at low cost. In operating sad irons and tailors' gooses, small glue pots, soldering irons, pitch heaters, etc., sufficient compensating advantages are found to offset increased prime costs in case they occur and the outlook for extended applications in the industrial field is favorable. The ability to minutely subdivide the heat energy, or, in other words, the elasticity of the system, makes it of special importance for use in manfacturing work.

It is impossible within the prescribed limits of this article to give more than a passing glance at the different factors in electric heating. We may perhaps best sum up the various sides of the problem :

1. In constructing a thermal system, we may employ electricity as the high potential heat factor by resistance heaters, or we may employ it as agent in operating motors to drive a suitable machine to secure diffused heat control.

2. In a multi-potential thermal system the useful heat available is practically five parts low potential heat and one part high potential heat.

In domestic life the ratio of heat required is found to be practically five parts diffused heat and one part high temperature heat. Over limited distances we may therefore economically operate multi-potential thermal systems, using electricity as the high potential factor.

3. Electric heating is synonymous with central station heating, presupposes the same generic elements, and requires for economy a complete thermal system in which due regard is paid to proportioning the work done in accordance with the heat equivalents of the factors employed, all of which must be in such form as to constitute elements of a telethermal system.

4. Where the mechanical equivalent of heat only is available as from motors, water-powers, gas engines, etc , we can economically employ electricity only for high temperature work; for diffused heating on a large scale, we must employ it as agent.

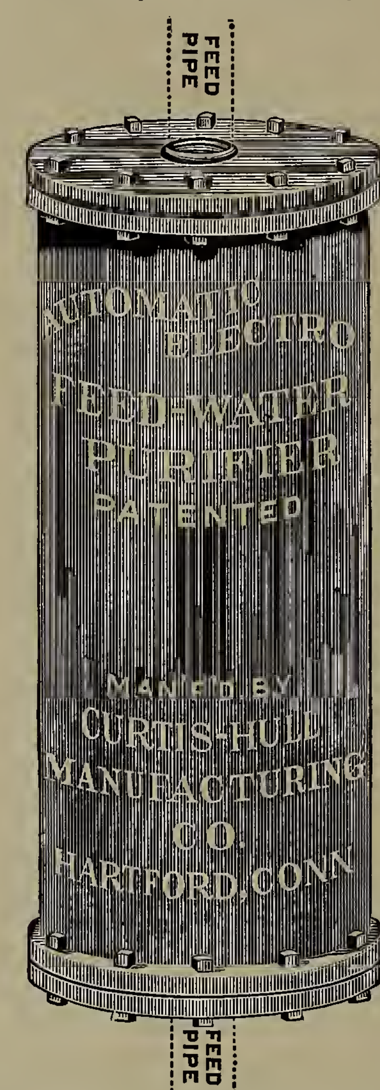
5. By constructing complete thermal system in which steam and electrical engineering are factors, the heat engineer can make electric heating a source of wealth to the owner of the system and a source of economy to the user of the heat energy, and therefore secure an advance on existing heating systems.

ELECTRO FEED-WATER PURIFIER.

The "Automatic Electro Feed-Water Purifier," of which we give an illustration, is designed to purify water, so far as its scale-forming properties are concerned, before it enters the boiler.

It has been practically tested in many leading plants for the past four years, and is giving excellent satisfaction.

The operation of the purifier is essentially electric. In the iron cylinder are specially prepared metals which, in connection with the flow of water at a temperature of not less than 150° F., and the acid in the water, a current is generated which destroys the affinity of the different



ELECTRO FEED-WATER PURIFIER.

scale-making ingredients for the iron of the boiler, and for each other. The water thus treated is rendered non-scaling before it enters the boiler. It is stated that any old scale in the boiler will gradually rot and drop off by the action of the electrically purified water.

The efficiency of this purifier is retained for from one to two years. When the electric action stops a new purifier should be put in.

The Automatic Electro Feed-Water Purifier is manufactured by the Curtis-Hill Mfg. Co., of Hartford, Conn. Their pamphlet shows a long list of testimonials concerning these purifiers, and the company make a liberal offer in order to encourage engineers to test the merits of their device.

New York Notes.

Office of the Electrical Age,
World Building, New York,
May 20, 1895.

Mr. H. D. McIntire, of the Electric Engineering and Supply Company, Syracuse, N. Y., was in town last week.

Mr. F. M. Hawkins, New York representative of the Electric Engineering and Supply Company, Syracuse, N. Y., has opened his new offices and salesrooms in the Thames building, corner Thames and Greenwich streets.

John C. Knight, E. E., inventor of the Knight alternating and direct current arc lamp has just returned from France. While in that country Mr. Knight secured the agency for the United States for the celebrated Lacombe arc lamp carbons.

The Boettiger-Kelly-Milne Company, engineers and general contractors, 39 Cortlandt street, New York, make a specialty of power plants for all purposes. They are also agents for the Ball Engine Co., of Erie, Pa. Mr. Boettiger is the designer and engineer; Mr. Kelly the constructor, and Mr. Milne the business man of the firm.

The Claus Electrical Works, 115 East 13th street, city, P. Claus, manager, is doing a good business. Mr. Claus lately installed a fine plant in a well-known restaurant on 14th street. There are three hundred 16-c. p. lamps, and two Solar arc lamps; also 20 fan motors. The company has just closed an order for $8,000 worth of apparatus, and has besides several other good orders in hand.

The General Term of the Supreme Court, on May 17, affirmed the judgment of the lower court dismissing the suits brought by the Empire City Subway Company to restrain the Broadway and Seventh Avenue Railroad Company and the Columbus and Ninth Avenue Railroad Company from using their cable conduits for the reception of telegraphic or telephonic conductors on the line of their roads. Judge Follett says that it does not appear that the Subway Company has any exclusive franchise. These railroad companies were empowered to "use a system of signals to the central house to stop the engines in case of accident," and for that purpose they were not bound to use the conduits of the Subway Company. "If," says the judge, "the construction of the Subway statutes contended for by the plaintiff is to prevail, it would be impossible for a surface road to be operated on many of the streets by electricity, as authorized by chapter 531 of the laws of 1889, unless its conductors were placed in the plaintiff's subways." W. T. H.

Street Railway Notes.

W. A. Hudson and J. C. Smith, Greenville, S. C., are after a franchise for an electric railway in that place.

An electric road is to be built between Lake Worth and Palm Beach, Fla.

The Troy City Railroad, Troy, N. Y., proposes to extend its line from Albia to West Sand Lake.

The Hoopeston Electric Railway Co., Hoopeston, Ill., proposes to build a line from Hoopeston to Gilman and other points.

The Versailles Electric Street Railway Co., Boston, Pa., will extend its line to Buena Vista, Scott Haven and West Newton, Pa.

An electric railroad is to be built between North Towanda and Canton, Pa.

Skowhegan and Madison, Me., are to be connected by an electric railroad.

The Consolidated Traction Co., Atlanta, Ga., has in contemplation several extensions of its electric lines.

The White-Crosby Co., Baltimore, has secured the contract for the extension of the Hall's Springs electric line of the City Passenger Railway Co., of that city.

Julian Fishburne, Charleston, S. C., is interested in a plan to build an electric road in that city.

The Clayton and Delmar Avenue Railway Co., St. Louis, Mo., will extend its lines, permission having been obtained.

The Youngstown Electric Railroad Co., Youngstown, Ohio, proposes to extend its lines to Girard and Niles, to connect with the Mahoning Electric Railway Co.

Mr. Tom L. Johnson, Cleveland, O., will build an electric railway between Cleveland and Lorain. His steel plant is located at the latter place.

The Jenkins conduit system will be adopted on the proposed electric road in Richmond, Va., which will run to Chimborazo Park. Edmund Pendleton, Jr., is the company's representative.

The Inland Electric Railroad, which is to connect Bucyrus and Sulphur Springs, Ohio, is full of promise. The citizens of the latter place have subscribed for $15,000 of stock.

The State Railroad Commissioners at Albany have approved the application of the Buffalo and Tonawanda Electric Railway Company for permission to increase its capital stock from $100,000 to $250,000.

The following-named street railroad companies in New York city have filed certificates of extension with the Secretary of State: Central Park, North and East River Railroad Co., and the Broadway and Seventh Avenue Railroad Company.

Application has been made in Newark, N. J., by Eugene Vanderpool, receiver, for permission to sell the Orange cable road. The application states that the road is operated at a loss of $9 per day. The liabilities of the company are $777,939, and the assets $180,955. Vice-Chancellor Emery directed that the sale take place within two weeks.

The Third Avenue Railroad Company, New York, has declared a semi-annual dividend of four per cent., payable May 29. The report of the company for the quarter ending March 31, shows gross earnings $580,124; increase over 1894, $194,536; operating expenses, $351 971; increase, $98,603; net earnings, $228,153; increase, $95,933. Cash on hand, $584,572; profit and loss surplus, $319,196.

Boston has one of the largest and most complete local and suburban street railway systems in the world. From the centre of the city, lines radiate in every direction, running as far as fifteen miles away. The trolley system was introduced in 1888, since which time the change to the electric system has been rapid. There now remains less than fifteen per cent. of the total mileage operated by animal power. The total length of track of Boston's street railways is 550 miles.

A majority of the bondholders of the Milwaukee Street Railway Company have decided to reorganize the company. With that object in view application has been made for the appointment of a receiver for the company. The company has been in default in payment of interest upon its first mortgage bonds for a year and a half, but by agreement the holders of the bonds have not pressed their claims. The largest holder of the bonds is the North American Company, and as the proposed reorganization has been undertaken with the view of placing its securities upon a better basis, that company will obviously derive the greatest benefit from the proposed readjustment.

An "anti-trolley" meeting was held in Brooklyn on the night of May 15. The object of the gathering was, it is stated, to make war on "trolley and other trusts." Resolutions were passed declaring among other things that "State prison was the place for incorporated as well as individual man-slayers;" calling for the prompt indictment of officers of the trolley companies; the employment of trained and licensed motormen; a strict enforcement of the ordinances governing trolley lines, and the adoption of a safe fender. Addresses were made by various persons, including Frank Lewis, a boy who had lost a foot by being run over by a car. Mrs. Henry Ward Beecher in a letter read before the meeting referred to the cars sneaking through the streets at a snail's pace as "nothing but a ruse on the part of the companies." There was "great enthusiasm," but it would have been more dignified if more moderate language had been used in the resolutions. A calm statement of facts has more effect than the use of violent and extravagant expressions, and an appeal to reason can accomplish more beneficial results than a momentary excitement of passion.

Telephone Notes.

The Clifton Forge Telephone Company, Clifton Forge, Va., will open two exchanges, one in Clifton Forge and the other in Covington, Va., which will cover a territory of about 24 miles in length. The two exchanges will be about 15 miles apart and there will be about 50 'phones at each end. In the other towns there will be pay stations. Mr. J. S. Patterson, Clifton Forge, is the manager of the company.

The International Bell Telephone Co, Limited, of New York city, has filed with the Secretary of State a certificate of reduction of its capital stock from $1,700,000 to $1,000 000. The certificate is signed by Samuel D. Babcock, Gardiner G Hubbard, William Mertens, Richard A. McCurdy, Charlton T. Lewis, and Howard S. Randall, directors of the company. Of the stock to be cancelled, $402,800 worth was held in the treasury of the company. The debts and liabilities of the corporation do not exceed $200,000.

The Superior Telephone Co., West Superior, Wis., has asked for charters to establish exchanges in Duluth and Superior. Four hundred subscribers have already been secured in Superior and six hundred in Duluth. The transmitter and receiver will be of a new style compound magnet type, and four cells of Samson battery will be used in each outfit. The same company is establishing four small systems in the State of Virginia. Mr. J. S. Patterson, electrician of the company, is now in West Superior directing affairs there.

The newly chartered Hinton Telephone Co., Hinton, W. Va., has organized with P. K. Letsinger, president; J. Alex. Parker, vice-president; J. M. Ayres, secretary. Construction work will begin at once.

The Home Telephone Company, Baltimore, Md., will soon need telephone equipment. Address 219 East Fayette street.

NEW TELEPHONE COMPANIES.

The Popular Telephone Company, Watsonville, Cal., by C. A. Rice, W. H. Lamb, Joseph Schwartz and others. Capital stock, $25,000.

The Anthracite Telephone and Supply Company, Shamokin, Pa. Capital stock, $10,000.

The Mutual Benefit Telephone Company, Northeast, Erie County, Pa. Capital stock, $1,000.

The Columbia Telephone Company, Columbia, Pa. Capital stock, $5,000.

TELEPHONE PATENTS ISSUED MAY 14, 1895.

Telephone. Morris Martin, Malden, Mass. (No. 539,068.)

Telephone Transmitter. Robt. F. Rice, Hartford, Conn. (No. 539,086.)

Annunciator Connection for Multiple Switchboards. Giles Taintor, Keene, N. H. (No. 530,039.)

Telephone Circuit and Apparatus. Chas. W. McDaniel, Kansas City, Mo. (No. 539,142.)

Telephone Transmitter. Alfred C. Brown, London, Eng. (No. 539,163.)

Mounting for Telephones. Thomas Kelly, Philadelphia, Pa. (No. 539,274.)

Possible Contracts.

An electric light plant is to be established in Lebanon, Vt.

The Union Electric Company, Manchester, N. H., proposes to make large improvements to its water-power plant.

A Mr. Davison is at the head of an enterprise to organize telephone systems in Brewton, Ala.

The Oglethorpe Electrical Light Co., Oglethorpe, Ga., proposes to erect telephone lines.

A telephone exchange will be established in Independence, Mo., by Haley & English, of Quincy, Ill.

Elizabeth City, N. C., has granted a ten-year franchise for a telephone system.

Cullman, Ala., will probably establish an electric light plant.

I. Bailey is at the head of a committee appointed by the City Council of Madisonville, Ky., to ascertain the cost of an electric light plant for that place.

Scotland Neck, N. C., is talking electric light.

Murfreesboro, Tenn., will issue bonds for the erection of an electric light plant. The Mayor can give further information.

It is proposed to establish an electric light plant in Salem, W. Va.

F. J. Ansley, Atlanta, Ga., will build a $200,000 hotel in that city at once. A. B. Steele will also erect a large hotel in Atlanta, for which Bruce & Moyan are preparing plans.

Alterations in the Auditorium, Baltimore, Md., will cost $100,000. Jas. L. Kernan has the matter in hand.

The Sinepuxent Beach Co., Baltimore, Md., is ready to receive plans for its $120,000 hotel.

New Corporations.

The Tacoma, Burnt Mills & Sandy Springs Railway Company, of Montgomery County, Sandy Springs, Md., has been incorporated by J. B. Colegrove, M. R. Sliney, Allen Freas, F. Ray Keys and B. H. Colegrove The proposed road will begin in Montgomery County at a point at the boundary line with the District of Columbia, and extend through Prince George's county to Ellicott City by way of Sandy Springs. Capital stock, $100,000.

The Chenoa Electric Light and Power Company, Chenoa, Ill., incorpoated by Noah H. Pike, W. R. Bennett and W. L. Miller, has been granted a franchise for lighting the city by electricity.

Florida Railway, Light, Power and Heat Co., Longwood, Fla. Capital, $400,000. A. Meuser, Longwood, president; J. M. Saunders, Palm Springs, Fla., secretary-treasurer.

The Carolina Mutual Telephone and Telegraph Co., Charleston, S. C. Capital, $30,000. Bailey & Libby, Charleston, can give further information.

Trade Notes.

The sole agency in Canada for the Boudreaux dynamo brush has been given to R. E. T. Pringle, Imperial building, Montreal. Mr. Pringle being thoroughly acquainted with everything pertaining to electiicity, will have no trouble in convincing users of dynamo brushes that the Boudreaux anti-friction metal brush realizes all desiderata.

R. B. Corey, general sales agent of the General Incandescent Arc Light Company, New York, has just issued from his office in the Havemeyer building, an artistically gotten up catalogue of Bergmann arc lamps for direct or alternating currents. The illustrations show lamps of many designs, from the plainest to the most elaborately

ornamented and finished. The catalogue also embraces a line of ornamental arc lamp brackets.

Catalogue No. 9,503 of the C. W. Hunt Company, of 45 Broadway, New York, which is just out, is devoted to industrial railways for manufacturing establishments. It is very fully illustrated, and shows the various designs of cars, rail sections, tracks, curves, crossings, turn-tables, etc., made by this company, with an abundance of interesting descriptive matter. Steam and electric locomotives are also manufactured by the Hunt Company.

H. B. Coho & Co., 203 Broadway, New York, call attention to the fact that they are not wiring contractors, nor consulting engineers. They give all their time to electrical machinery of every description, and claim to know their business.

WOVEN WIRE BRUSHES.

The Belknap Motor Co., of Portland, Maine, are the patentees and manufacturers of the best woven wire commutator brush on the market.

Electrical and Street Railway Patents.

Issued May 14, 1895.

539,024. Electrical Connector. Frank N. Bell, Milford, Mass. Filed July 28, 1894.

539,032. Carbon-Brush Holder for Dynamos. Winfield S. Bosley, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Sept. 8, 1894.

539,040. Insulator. Leonard H. Desisles, Boston, Mass., assignor of one-third to Frederick S. Palmer, same place. Filed Sept. 10, 1894.

539,042. Car-Fender. Albert Edwards, Brooklyn, N. Y. Filed Feb. 9, 1895.

539,048. Car-Fender. Andrew E. Flattick, St. Louis, Mo. Filed Jan. 28, 1895.

539,050. Car-Fender. William B. George, Columbus, O. Filed Dec. 6, 1894.

539,068. Telephone. Morris Martin, Malden, Mass. Filed Nov. 10, 1886.

539,079. Electric Push-Button. August J. Oehring, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Nov. 2, 1893.

539,086. Telephone-Transmitter. Robert F. Rice, Hartford, Conn., assignor to Francis H. Richards, same place. Filed May 18, 1893.

539,099. Annunciator Connection for Multiple Switchboards. Giles Taintor, Keene, N. H., assignor, by mesne assignments, to the Western Electric Company, of Illinois. Filed Apr. 11, 1892. Renewed Mar. 13, 1893.

539,105. Variable Rheostat. Ernest P. Warner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Sept. 18, 1894.

539,123. Cross-Arm for Carrying Electrical Wires. Thos. T. Eckert, New York, N. Y. Filed Mar. 20, 1895.

539,134. Car-Fender. Henry P. Johnson, San Francisco, Cal. Filed Aug. 16, 1894.

539,142. Telephone Circuit and Apparatus. Charles W. McDaniel, Kansas City, Mo. Filed Mar. 16, 1895.

(*Continued on Page* 302)

National Electric Light and Street Railway Associations.

NATIONAL ELECTRIC LIGHT ASSOCIATION.

President, C. H. WILMERDING, Chicago, Ill.; 1st Vice-President, FREDERIC NICHOLLS, Toronto, Canada; 2d Vice-President, E. F. PECK, Brooklyn, N. Y.

Members of Executive Committee: E. H. DAVIS, Williamsport, Pa., (one year); W. R. GARDINER, Pittsfield, Mass.; GEORGE A. REDMAN, Rochester, N. Y.; J. J. BURLEIGH, Camden, N. J. Next meeting, New York, May or June, 1896.

AMERICAN STREET RAILWAY ASSOCIATION.

Next meeting, Montreal, Que., October, 16, 17 and 18, 1895.

President, JOEL HURT, Atlanta, Ga.; Vice-President, W. WORTH BEAN, St., Joseph, Mich.; 2d Vice-President, JOHN M. CUNNINGHAM, Boston, Mass.; 3d Vice-President, Russell B. Harrison, Terre Haute, Ind., Secretary and Treasurer, WILLIAM J. RICHARDSON, Brooklyn, N. Y.; Executive Committee, HENRY C. PAYNE, Milwaukee, Wis.; W. H. JACKSON, Nashville, Tenn.; D. G. HAMILTON, St. Louis, Mo., C. C. CUNNINGHAM, Montreal, Canada; J. N. PARTRIDGE, Brooklyn, N. Y.

NEW YORK STATE STREET RAILWAY ASSOCIATION.

Next meeting, Albany, N. Y., third Tuesday in September, 1895.

President, G. TRACY ROGERS, Binghamton; First Vice-President, JOHN H. MOFFITT, Syracuse; Second Vice-President, W. W. COLE, Elmira; Secretary and Treasurer, WILLIAM J. RICHARDSON; Brooklyn; Executive Committee, D. B. HASBROUCK, New York; JOHN N. BECKLEY, Rochester; DANIEL F. LEWIS, Brooklyn.

OHIO STATE TRAMWAY ASSOCIATION.

Next meeting, fourth Wednesday in September, 1895.

President, ALBION E. LANG, Toledo; Vice-President, W. J. KELLY, Columbus; Secretary and Treasurer, J. B. HANNA, Cleveland; Chairman Executive Committee, W. A. LYNCH, Canton.

MASSACHUSETTS STATE STREET RAILWAY ASSOCIATION.

President, T. H. CUNNINGHAM, Boston; Secretary and Treasurer, A. S. BUTLER, Lawrence; Executive Committee, SAMUEL WINSLOW, ALFRED A. GLAZIER, Boston; P. F. SULLIVAN, Lowell; E. C. FOSTER, Revere; HORACE B. ROGERS, Brockton; A. E. SMITH, Springfield; PRENTISS CUMMINGS, Boston.

THE TEXAS STREET RAILWAY ASSOCIATION.

President, W. H. SINCLAIR, Galveston; vice-president, C. A. MCKINNEY, Houston; Secretary and Treasurer, C. L. WAKEFIELD, Dallas. Directory: The officers and W. H. WEISS, San Antonio and GEORGE B. HENDRICKS, Fort Worth.

Next meeting, Galveston, third Wednesday in March, 1896.

PENNSYLVANIA STATE STREET RAILWAY ASSOCIATION.

Next meeting, first Wednesday in September, 1895.

President, JOHN A. RIGG, Reading; First Vice-President, ROBERT E. WRIGHT; Secretary, S. P. LIGHT, Lebanon; Treasurer, W. H. LANIUS, York.

THE MAINE STREET RAILWAY ASSOCIATION.

President, W. R. WOOD, Portland; Secretary and Treasurer, E. A. NEWMAN, Portland; Executive Committee, W. R. WOOD, Portland; GEORGE E. MACOMBER, Augusta; F. M. LAUGHTON, Bangor; FRANK W. DANA, Lewiston; AMOS F. GERALD, Fairfield.

MICHIGAN STATE STREET RAILWAY ASSOCIATION.

President, W. L. JENKS, Port Huron; Vice-President, W. WORTH BEAN, St. Joseph; Secretary and Treasurer, B. S. HANCHETT, JR., Grand Rapids; Executive Committee, the OFFICERS and DAVID H. JEROME, Saginaw, and STRATHERN HENDRIK, Detroit.

THE STREET RAILWAY ASSOCIATION OF THE STATE OF NEW JERSEY.

President, THOS. C. BARR, Newark Vice-President, W. S. SCULL, Camden; Secretary and Treasurer, CHARLES Y. BAMFORD, Trenton; Executive Committee, OFFICERS and C. B. THURSTON, Jersey City; H. ROMAINE, Paterson S. B. DOD, Hoboken.

539,150. Electric Lamp. William H. Sheppard, New York, N. Y. Filed Nov 20, 1894.

539,163. Telephone-Transmitter. Alfred C. Brown, London, England, assignor of one-half to George Richard Neilson, same place. Filed Sept. 27, 1894.

539,169. Car-Fender. Andrew J. Collier and Philip M. May, Washington, D. C ; said May assignor of his entire right and said Collier assignor of one-third of his right, by direct and mesne assignments to George P. Davis, same place, and William B. Dickey, New Orleans, La. Filed Sept. 1, 1894.

539,170. Magneto-Call Apparatus. Frank B. Cook, Chicago, Ill., assignor to the American Bell Telephone Company, Boston, Mass. Filed Dec. 26, 1894.

539,184. Closed-Conduit Electric Railway. Paul Lucas, Berlin, Germany. Filed June 23, 1894. Patented in Belgium Mar. 12, 1894, No. 108,976 and in Germany June 15, 1893, No. 76,141.

539,192. Electric-Light Head-Gear for Personal Wear. Alfred M. Rodriguez, Brooklyn, N. Y., and Edward D. Rockwell, Bristol, Conn. Filed Feb. 25, 1895.

539,216. Rheostat. Augustus C. Carey, Lake Pleasant, Mass. Filed Feb. 26, 1895.

539,222. Electric Conductor. John R. Hare, Baltimore, Md. Filed Nov. 23, 1894.

539,234. Electric Fire and Water Alarm. Gustave S. Neu, New York, N. Y. Filed Jan. 25, 1895.

539,242. Car-Wheel for Electric Cars, &c. Charles Thompson, Oswego Falls, assignor of one-half to George J. Emeny, Fulton, N. Y. Filed Nov. 22, 1894.

539,265. Fender for Street-Railway Cars. Charles R. Hall, Philadelphia, Pa., assignor of one-sixth to Louis Bash, same place. Filed Sept. 29, 1894.

539,274. Mounting for Telephones. Thomas Kelly, Philadelphia, Pa, Filed Sept. 8, 1894.

539,277. Electric Motor. John C. Lincoln, Rochester, N. Y., assignor to L. S. Graves & Son, same place. Filed Jan. 16, 1892.

539,281. Car-Fender. Marguerite Maidhof and Victor F. Maidhof, New York, N. Y. Filed July 30, 1894.

539,293. Controller for Electric Motors. Horace F. Parshall and John W. Darley, Jr., Lynn, Mass., assignors to the General Electric Company, of New York. Filed Feb. 11, 1893.

539,299. Electric Track-Switch. Joseph Y. Porter, Cleveland, Ohio, assignor to J. W. Morrison, Detroit, Mich. Filed Feb. 14, 1894.

539,302. Electric Glass-Cutting. Israel L. G. Rice, Weston, Mass. Filed Jan. 2, 1895.

539,342. Car Guard or Fender. James O. Brown, Boston, Mass., assignor to himself, Rolon E. Foster, and Robert B. Graham, trustees, same place. Filed Jan. 10, 1895.

539,358. Electric Stop-Motion for Warping-Machines. Clayton Denn, John Cocker, and Charles Denn, Philadelphia, Pa. Filed Jan. 11, 1895.

539,365. Electric-Arc-Lamp Clutch. Wm. B. Luce, Brookline, Mass., assignor to E. S. Ritchie & Sons, same place. Filed Mar. 15, 1894.

539,376. Starting-Box for Electric Motors. Donald M. Bliss, Boston, Mass , assignor to the Holtzer-Cabot Electric Company, same place. Filed Feb. 20, 1895.

539,385. Operating Fenders for Street-Railway Cars. Charles R. Hall, Philadelphia, Pa., assignor of one-half to Charles E. Jones and Louis Bash, same place. Filed June 27, 1894.

539,393. Electric-Arc Lamp. Charles A. Pfluger, Chicago, Ill., assignor to the Standard Electric Company, same place. Filed July 2, 1894.

ELECTRICAL AGE

VOL. XV., No. 22. NEW YORK, JUNE 1, 1895. WHOLE No. 420

ESTABLISHED 1883.

Entered at New York P. O. as second-class matter, January 18, 1891.

THE ELECTRICAL AGE PUBLISHING CO., PUBLISHER

TERMS OF SUBSCRIPTION:

One Copy, one year,	$3.00
One Copy, six months,	1.50
Great Britain and other Countries,	4.00

Cable Address (all Cables,) "Electage," New York.

W. T. HUNT, President. F. N. BASSETT, Vice-President.

T. R. TALTAVALL, Secretary and Editor.

NEWTON HARRISON, E. E., Scientific Editor.

Canadian Representative, E. W. SAYER, Montreal, Que.

ADDRESS ALL COMMUNICATIONS TO

THE ELECTRICAL AGE PUBLISHING COMPANY,

FIRST FLOOR, WORLD BUILDING.

NEW YORK.

NEW YORK, JUNE 1, 1895.

CONTENTS.

THE TELEPHONE SITUATION.

Most of the independent telephone companies are pushing their business as energetically as if the disturbing element known as the Berliner patent had never existed. To them it matters little whether the Berliner patent is dead or alive. They are entirely independent of it, and they are sailing along as smoothly as could be wished. Their big rival is doing all the worrying.

NEW YORK'S UNDERGROUND CONDUIT ROAD.

The operation of the underground electric conduit road on Lenox avenue, in the upper section of this city, is being watched with great interest by street railroad men in general. Much depends upon the result of this experiment; if it fails to meet every demand upon it the cause of the underground conduit principle will receive a set back; if it proves entirely satisfactory, however, it will unquestionably mark a new era in street transportation in large cities, where the overhead trolley is not permissible. The Lenox avenue line has so far been doing very well for a new system. No hitches of any consequence have occurred, and the enterprise bids fair for success. This road forms part of the Metropolitan Traction Company's system.

MUNICIPAL CONTROL NOT FAVORED.

The advocates of municipal control of semi-public enterprises will find something to reflect upon in the report that the Japanese Diet has been petitioned to transfer the telephone service in that country from State to private control. No reason is given for this action, but it is presumed that the State management of the telephone is not up to the Japanese ideal. Quite a picture—Municipal control running riot in America, while in Japan, where the State has been everything, they are yearning for some private enterprise.

FIRE UNDERWRITERS' RULES.

The recent action of the New York Board of Fire Underwriters in endorsing and recommending the use of "Attix" wire in electric installations has stirred up a veritable hornet's nest. Prof. Anthony first brought the matter to public attention in a paper read by him before the American Institute of Electrical Engineers on April 17 last, and its importance was at once recognized by all present. An animated discussion followed the reading of the paper, and the subject was deferred to the next meeting of the Institute in order to bring out the views of those who would probably wish to be heard upon the subject, but who were absent. At the next meeting the matter was thoroughly considered, the opinion of all the speakers without exception being, that if the order were allowed to stand it would really be making "progress backwards." The objections were not aimed at the "Attix" wire itself, but to its use without tubing or raceways, according to the best standard practice. Recognizing the importance of the subject the insurance journals have taken up the matter in strong opposition to the Underwriters' ruling. These papers are as well aware as anyone of the dangers that the application of the rule would incur, and are doing good work in revealing in its true light the error made by the Board. We reprint on another page of this issue an editorial article from the *Insurance Advocate* of this week, which shows how seriously the matter is regarded by those in a position to thoroughly comprehend the situation. The Board of Fire Underwriters cannot act too quickly in rescinding the objectionable ruling. Electric wiring is no longer in an experimental stage; it has become a settled industry, based upon practical and dearly-bought experience, and to depart from this practice and introduce a well-known element of danger is nothing short of foolhardiness in the highest degree. In addition to the article referred to we also print some of the remarks made on the subject by prominent and experienced electrical engineers at the earlier meeting of the American Institute of Electrical Engineers in the discussion of Prof. Anthony's paper.

WHAT SHALL BE THE STANDARD FOR INTERIOR ELECTRICAL INSTALLATION?

Under this heading the *Insurance Advocate*, of New York, will on June 1 publish the following editorial article:

"A very warm discussion as to the relative excellence and safety of two systems of interior electrical installation has been precipitated by the adoption by the New York Board of Fire Underwriters of a resolution placing Attix wire on a par with the conduit system for the purposes of such installations. The chairman of the electrical committee, Mr. F. C. Moore, has been chiefly instrumental in securing the adoption of this resolution, enough members voting with him to carry it through.

"The particular merits and demerits of the wire selected for approval by the electrical committee of the New York Board we have fully discussed in another column. But there is a broader and more vital question involved than that of the suitability of this Attix wire for the purposes for which the New York Board has authorized its use, or whether it can with decent regard for truth and sense be called a *tube*. The greater question is—What is a suitable and proper standard of interior electrical installation for the approval of underwriters? and is such a standard, having been determined, to be enforced?

"If we answer the first query in general, not specific, terms, there is and can be but one answer to it, namely—The only proper standard for the approval of underwriters is the highest and safest that has, at any given time, been attained. In their own interest, and in the interest of the property-owner, the rules of underwriters should name in their requirements the best and the best only. The rules of the New York Board (which are those recommended by the Underwriters' International Electric Association), unaffected by the Attix wire resolution, require that all interior conduits 'must be first installed as a complete conduit system, without conductors, strings, or anything for the purpose of drawing in the conductors, and the conductors then to be pushed or fished in.' In the case of Attix wire, or any similar wire, it would be impossible to comply with this requirement, as what Mr. Moore and Prof. Morton are pleased to call a tube in wire of that sort is part and parcel of the insulation, and in no sense a conduit. The rules provide further that 'the conductors must not be placed in position until all mechanical work has been, as far as possible, completed.' In the case of Attix wire the conductor is necessarily put in in early stages of the mechanical work, and must then be left exposed to every careless act of the artisans and workmen. A further paragraph of the rules in relation to interior conduits reads thus: 'Must not be so placed as to be subject to mechanical injury by saws, chisels, or nails,' Attix wire, being protected by its insulation only, would be subject to such injury wherever drawn beneath floors or between walls. A foot-note referring to interior conduits reads as follows: 'The object of a tube or conduit is to facilitate the insertion or extraction of the conductors, to protect them from mechanical injury, and, as far as possible, from moisture. Tubes or conduits are to be considered merely as raceways, and are not to be relied on for insulation between wire and wire or between the wire and the ground.' What is there about Attix wire that would constitute a raceway, or that would facilitate the insertion or extraction of the conductor?

"On another page we print a paper by Prof. W. A. Anthony, which was presented at the meeting of the American Institute of Electrical Engineers held in New York on April 17th, in which the Attix wire resolution of the committee on electricity of the New York Board is referred to as 'one of those reversions to an ancestral type which we find in all evolutionary development, which is off the general line of progress, and which is destined to become extinct.' At the meeting referred to, such men as Messrs. C. O. Mailloux, Wm. J. Hammer, H. Ward Leonard, Franklin S. Holmes, W. J. Jenks, James I. Ayer, C. J. H. Woodbury and Fremont Wilson, all condemned this resolution as a backward movement, and complained bitterly of the lack of uniformity and frequent changes (not always in the line of progress) in the requirements of underwriters' rules, and of the executive management of the electrical inspection department of the New York Board. Nor do these gentlemen make complaint without just cause.

"These things ought not to be. Underwriters cannot afford to take backward steps, nor 'revert to ancestral types,' in this matter of the standard of electrical equipment. We have no grudge against Attix wire. But it is plain to be seen that Attix wire, or any other wire of similar make, fails entirely to come up to the requirements of the standard rules. All the advancement that has been made in the art of insulation during the last five years has been in the line of improving the conduit system, with a view to simplicity, strength, and safety. Such a resolution as that of the New York Board simply wipes out that progress and leaves matters where they were in the days when wires were buried in walls without order or system, there to remain and degenerate until a fire occurred or they were removed at great cost by means of chisel and pick.

"It is certainly our belief that the electrical committee of the New York Board ought to lose no time in taking advantage of the phrase 'until further notice' in the resolution adopted by it, and notify the superintendent that the rules regarding interior conduits are to be rigidly enforced, and no exception made of Attix wire or any other wire that does not conform to their requirements."

STEAM TURBINES.

BY G. EMIL HESSE.

The tendency of designers of steam-engines has always been to get great economy and reduction of size and weight, the former because it means low running expenses and the latter small initial cost. This has led to the successful introduction of triple and quadruple expansion engines, the superheating of steam and greater increase of pressure and speed. The result of these improvements has been an increase of actual efficiency, which today is about 14 per cent. of the latent energy in the coal, this latter per centage however being obtainable only from the very best triple-expansion engines. It looks now as if the highest economy had been reached, and the only thing left therefore is to decrease the size and weight. It is my belief, that when this has been accomplished nothing more will be done with the steam-engine. There is no doubt that we, in the near future, will be able to produce electricity more economically direct from coal, and the natural result will then of course be the neglect of steam engineering.

The improvement of the steam-engine with regard to speed is nevertheless at the present time of the utmost importance to the electrical engineer. His requirements are not only great economy, but also high speed, especially when it comes to the direct-connected dynamo engine, and it has always bothered the designer of the triple-expansion engine to combine both economy and high speed.

The solution of this problem seems to me to be the steam turbine designed somewhat on the same lines as laid down by De Laval in his engine exhibited at the Chicago exposition. The speed of his turbine is all that can be desired, and is as high as 30,000 revolutions a minute in the 5-horse-power engine. The economy is also very satisfactory, and experiments with one of his larger turbines showed that 63.7 horse-power were obtained with a consumption of 8.95 kilograms of steam and 1.21 kilograms of coal per horse-power hour, which is as good a result as is obtained from the best triple expansion engines of the same size. It is more than likely that the steam turbine of the future will deviate greatly from Mr. De Laval's, but it is a pleasure to see that somebody has broken away from the old rotary engine idea, with which in my opinion, nothing can be accomplished.

The thing for inventors and engineers to do now is, therefore, to follow up the De Laval idea and make such improvements and changes as will make the turbine the favorite engine with electrical engineers and the public in general.

THE "E. R." SOCKET.

There is an obviously great field and demand for sôme practical means of regulating the intensity of the electric incandescent light. Gas can be turned down to any degree, but not so up to the present time with the electric light. It has had either to burn at its full capacity, or not at all. This disadvantage has been a serious one, and there has always been a desire for an incandescent light that could be turned down low when the full light is not desired.

The regulating socket, illustrated herewith, is designed to accomplish this object, and it does its work in a very

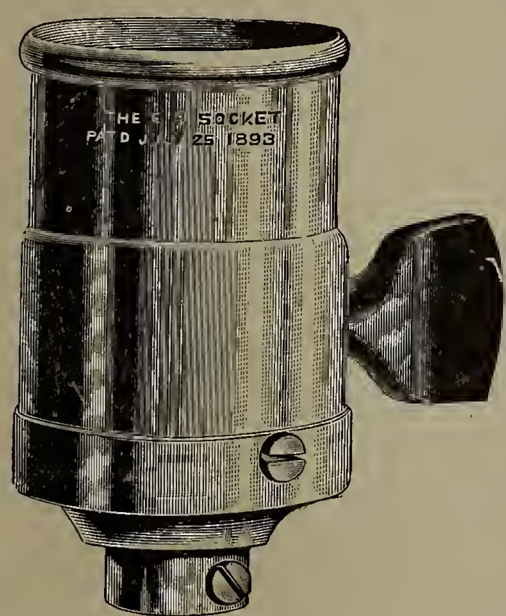


FIG. I.

satisfactory manner. The different degrees of light are obtained by the cutting in and withdrawal from the circuit of carbon resistances, in the form of short, small pencils. These resistances are set within the socket in a vertical position, one of them being very clearly shown in the illustration (fig. 2), which is cut away to expose the interior construction of the socket. There are four of these carbon resistances. They are successively thrown in series into circuit by means of a five-point switch within the socket, also shown in the illustration (fig. 2). In this manner the candle-power of the lamp can be varied in five degrees from full illumination to a mere glow.

This regulating socket is made in the same size as the ordinary socket, the interior construction being of porcelain with the carbonsand contact points mounted thereon.

Besides the great comfort and convenience this socket

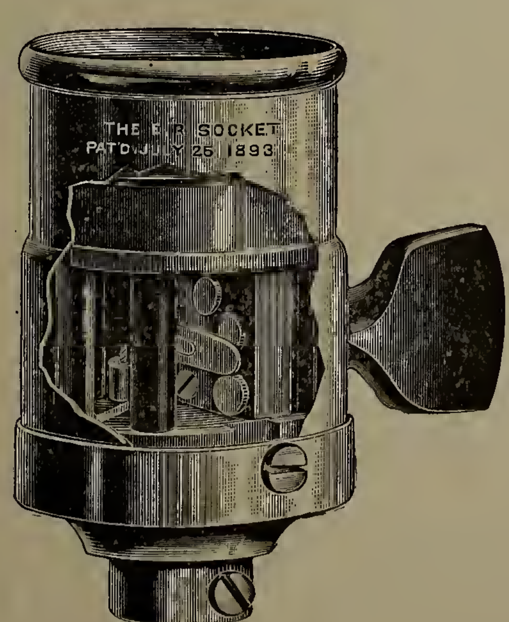


FIG. 2.

affords in practical use, it also effects a great saving of current at the meter; this economy amounting, it is claimed, to 69 per cent. at the last point of contact. In addition to these advantages another, not less important, is the prolongation of the life of the lamp itself, because the filament is relieved of the strain put upon it by the sudden inrush of current.

The "E. R." socket has been tested and endorsed by some of the highest authorities in the country. It is easily wired, and is adaptable to either direct or alternating current. The Company is now filling orders for sockets for 100 to 118 volts, and are manufacturing a special socket tor 50 to 55 volts, which will be ready to be placed upon the market in a short time.

The Electric Company, of 56 Broadway, New York, Mr. C. R. Duffie, Jr., general manager, is exploiting this device, and is meeting with very encouraging success.

SOLAR ARC LAMPS.

Arc lamps for incandescent circuits are meeting with more and more favor every day, as they become better known. For lighting large spaces nothing equals them, and the fact that they are found in large stores, factories, hotel corridors and similar places of public or semi-public character is the best possible acknowledgment of their worth.

Many lamps of this class have been produced. Some have survived the most crucial tests in practice and some have fallen by the wayside. Why they have failed is of no consequence to the reader. Our purpose just now is to call attention to one make of lamp that is a triumph.

The Solar arc lamp is characterized by its simplicity of construction and satisfactory service. The regulation is effected by escapement and rack mechanism, which is

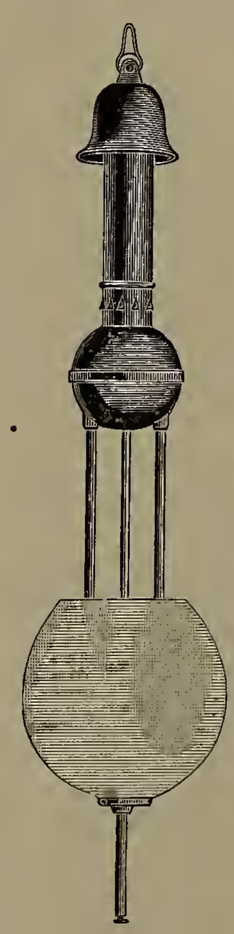


FIG. 2.

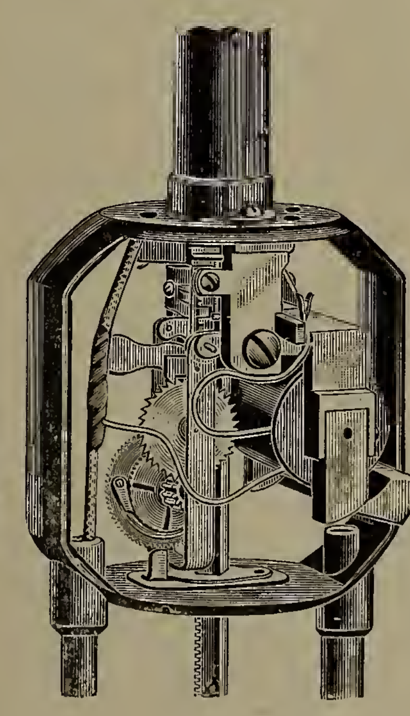


FIG. I.

FIG. 3.

acknowledged to be the best method of feeding for lamps of this class.

One of our illustrations (Fig. 1) shows the interior mechanism of the Solar arc lamp. The feeding of the upper carbon is accomplished by the weight of the carbon itself. The regulating magnet is wound with a shunt coil of fine wire across the arc, and when the carbon has been burned out the magnet circuit is opened by means of a specially designed cut-out.

The Solar arc lamps are made to burn two in series across circuits of 110 or 115 volts. Proper resistance coils are provided in the tubular receptacle on the top of the lamp frame, the amount of resistance being governed by the voltage and manner of connecting. The lamp contains no dash-pots, springs, counterweights, etc., which are undesirable features in lamps of this class, and altogether it is one of the simplest and most reliable lamps yet devised.

The Solar Arc Lamp Company, whose factory is at 351

Jay street, Brooklyn, is bringing out a lamp for use on series constant-current circuits. The cut-out used in this lamp is of novel construction, and the regulation of the lamp is very satisfactory.

The standard Solar lamp for incandescent circuits takes eight amperes of current, and burns nine hours. Its length is 28 inches. The 36-inch lamp burns fifteen hours, taking the same current.

Figs. 2 and 3 show plain and ornamental Solar arc lamps.

VISUAL SOUND—WRITING BY WORD OF MOUTH.

BY W. E. IRISH.

It is well known that the vibrations caused by the utterance of words, by musical notes and other sounds made near a telephone or transmitter diaphragm, or stretched drum head or any other flexible disk held firmly at its periphery, leaving its centre free, will vibrate in unison with the sounds conveyed to it.

There can be no doubt as to this fact in the mind of any one who has ever examined and studied the Bell telephone. The vibrations of the diaphragm at the transmitting end of a pair of Bell 'phones varies with every sound, but for the same sound the vibrations remain a fixed quantity, therefore it is necessary for the diaphragm at the receiving end to make exactly the same number of vibrations and in exactly the same time to reproduce the same sound which set in vibration the transmitting diaphragm.

This being the case it only remains for some one to devise a simple means whereby, instead of reproducing the sound as in a telephone, these vibrations are caused to be recorded in ink, so as to give a distinct character or figure for every different sound affecting the diaphragm.

When he has done this he will also have discovered the key to a universal language, and will have given to the world one of the greatest physical and mental labor-saving devices ever enjoyed.

It does not appear, and really is not, a great problem to solve.

Such a device would, in addition to being the key to a universal language and great labor-saver, also be the key to a universal system of recording our own thoughts and the thoughts of others by means of the same simple sound characters as in writing, printing, telegraphing; but, most important of all, it would be the means of *solidifying* the thoughts of our ablest men as fast as they could utter them.

Through its agency our children would acquire more useful knowledge in two years with far less labor than they, by the present system, can obtain in five years.

The letters of the alphabet and orthography as now known would be entirely abolished, and correct pronunciation and visual sound characters substituted.

The student would be helped by hearing the teacher pronounce the word that would at the same instant be visually represented to him.

Such a machine would write the whole of Webster's Dictionary with about fifty different characters all of which could be more readily learned than the spelling of fifty of the simplest words by means of the letters of the alphabet.

These characters would convey much more readily to the mind and senses their import than is possible by any other means.

The future generation would not be mentally taxed to reason out why if p-l-o-u-g-h spells plough, d-o-u-g-h must spell dough—(do).

The arbitrary characters which we use to express our thoughts visually are by no means limited to twenty-six or to several hundred, for the reason that there are in many instances over thirty accepted different types of character representing the same letter.

As true sound figures cannot be altered without changing their meaning we may hope, should they come into general use, that they may be permitted to retain their simple, natural form.

This apparatus would save the author, editor, reporter, student and commercial man the drudgery of the pen and enable them to preserve their brightest ideas.

The literary man would simply have to convey his best thoughts to the machine to have them accurately recorded at unlimited speed in characters which will not require transcribing to be understood by others.

A person having a knowledge of these characters would be able to read German, French, Spanish, or any other language recorded by the machine perfectly and with correct pronunciation, although the meaning might be quite unintelligible to him.

It would be a great help to the traveller in a foreign land, as well as to the student learning a foreign language. In the study of music these characters would be of immense advantage. Records of pieces played by our most able masters with feeling, such as notes alone cannot give, will represent the sheet music of the near future. In these visual sound characters, books and other printed matter will be published on one-fifth the amount of paper and with larger type and more distinct spacings, and when necessary these characters will be written with the pen.

A knowledge of these *visual sounds* will be acquired without any special effort or mental training, since while the learner listens to a 'phone he will see the characters, representing the words he hears, written, and while speaking he will see his own words recorded.

Such an instrument would be found an able automatic secretary and trustworthy automatic stenographer, and a reliable automatic typewriter, always ready and never tired or in the way.

These characters would be very much less complex and fewer in number than any arbitrary system of short-hand.

By the aid of such an apparatus telephones would be brought to their fullest measure of usefulness, as all messages would be recorded without additional trouble.

The sound recorder would soon become a requisite in every office, school and home. It would be the tutor, helpmate, slave and friend of everyone from baby to grandpapa, and from the hottentot to the scholar; even to the deaf, the blind, the dumb, or the armless it would be a comfort and a blessing, since all could use it.

We have but to call to mind the phonograph to remember that attempts have been made in this direction, but the stylus of the phonograph makes indentations in a soft medium, such as wax, from which the sounds may in a measure be reproduced. But these indentations have never been visually deciphered, and it is doubtful whether they ever will be. If a magnified section at the centre could be obtained, showing the variations in the depth, etc., of the indentations, it might then be possible to read them, but this plan could have no useful application.

In the successful instrument the stylus or pen must be free to vibrate and discharge a jet of ink, after the manner of the pen in Thompson's recording telegraph.

A NEW KINK IN DECORATIVE LIGHTING.

By accident a Parisian lady of fashion, renowned for the brilliancy of her entertainments, has discovered and utilized the beaded Japanese screen as a shade for incandescent lamps, the effect being wonderfully brilliant and pleasing. The rays of sun playing through the varied-colored beads of the screen attracted her attention and suggested to her inventive mind the adaptability of the beads for artificial light decoration, with the result that the intense rays from the incandescent film were split up into thousands of shafts of colored radiance with exquisite effect. The design has been brought over to this country and improved upon. This process has added immensely to the resources of decorative electric lighting.

—In determining the location of a power house the first thing to be considered is nearness to fuel supply, and, next, position with reference to water supply.

UNDERWRITERS' RULES.

(*Continued from Page 296.*)

I have now in hand a case where theinsurance inspectors inspected a large dry goods establishment in Brooklyn, I was called in by the proprietors of the establishment after they had made efforts during several months to adjust the matter with the insurance companies—I was called in by them to see what could be done in the matter. It took me three months to bring about a conference between the various insurance inspectors interested in it. There were some twenty odd companies who carried partial risks on the establishment, it being a very large one. I discovered very quickly that some of these inspectors wanted certain things done and other inspectors wanted that very thing not done, and so on, for a long list of requirements; yet they were all working from the same rules. Some of them told me that I must not allow any moulding to be capped. Others said that that was very wrong—the rules required it to be capped ; and so on through a long list of inconsistencies. I began in June. In October I succeeded in bringing about a conference between the different insurance companies at which I appeared as representative of my clients. I took delight in calling the attention of the seven or eight inspectors present to the fact that they were extremely inconsistent and arbitrary. I put it in those words and stated my reasons clearly, and this particular case furnished me ample reasons. I think it had a saltuary effect; a certain agreement was drawn which stated what these inspectors would agree to agree or disagree about. I had made so many efforts to satisfy them all that I had given up hope of doing so, and I thought all other efforts useless until I had their signatures as evidence to what they would or would not allow. It was no longer a question of rules. It was a question of what their individual preferences or whims might dictate. Now, gentlemen, I think that the electrical profession needs some attention, when it is placed in such a position as that. I think that not only looking at it from a scientific standpoint, but also from the standpoint of dollars and cents, it will pay us to go to the bottom of this thing. I believe that with the proper amount of suasion we ought to be able to place ourselves in a position where, instead of being dictated to, we may ourselves dictate, to some extent, what is proper. I do not think there is a more competent body in the United States to formulate rules and restrictions, to prescribe what is the proper thing to do in connection with electric wiring, or what is proper and desirable from the engineering standpoint. I submit that men who are business men merely, though they may have experience, are not so well fitted as those who have had the training and the experience of years, to do this. I think that with all the scientific men and all the practical men that this Institute contains, it is more competent than any other body to dispose of this question. I am in a position to assure this body that it has sympathy from the outside ; that it has sympathy from the very ranks of the insurance companies, which is saying a great deal; because I have already called to your attention the fact that they have dissenters, men who are dissatisfied with the way their business is transacted, and they are only waiting for a word of sympathy or encouragement, or some little energy on our part, and on the part of all the other associations interested in the electrical industries in order to give us a helping hand and bring about the desired change.

MR. JAMES I. AYER:—It is very gratifying to me, having worked with the Electric Light Assocation in relation to these rules for some years, to see the interest taken by the Institute in this matter. I think that if any additional arguments were needed I can cite a case which perhaps touches the engineer a little more directly and forcibly than some of the points made tonight: that is the tendency of the inspection department of the Board of Fire Underwriters to usurp the prerogatives of the electrical engineer; in other words, to issue certificates to contractors which pass as current coin as evidence that they have got what they paid for—a first-class electrical installation. There is not an engineer here engaged in practical work who has not run against it; who has not seen passed what should not have been passed, and the investors, the men who are paying for the installations, would have been very glad to pay the engineer's fees if they did not feel that they were getting something for nothing from the Board of Underwriters. A case of that kind came up only a few months ago where a very large installation was being made. The specifications were made partly by the manufacturing company and by the architect, who had a little assistance in getting them out. But after the contract was awarded, while there were unusual electrical problems involved in the construction work, the parties paying for the installation declined the services of an engineer because they thought they did not need one. They had a competent contractor, and realized that it was all right. Later on, when the installation was about to be completed, some comments were made by engineers who observed the work, and said it was bad, and all that. The question was raised in the Board of Directors—it was a very large corporation—as to whether it was all right or not. Some thought it was; they advocated the acceptance of the contract as tendered by the contractor, but the point was raised that there was a lack of thorough workmanship. Immediately the contractor brought in the argument that the insurance certificate that he possessed was an evidence of what they had got; that they had everything that they could demand or desire under the contract. The work was accepted. A month later they paid a considerable fee to an engineer to tell them what the matter was—why they could not successfully operate the plant. It took about $20,000 to correct the evil, and they paid an engineer to tell them how little value an insurance inspector's certificate is. It is not often they come out that way—that the engineer profits in the end by it. But it is a fact that the fire underwriters are stepping into the shoes of the electrical engineer; they are interfering with his profession, his business, and I know, as Mr. Hammer has well said here some of the members are anxious to have papers read here that would "get within five miles of the earth occasionally." We all know that this question of insurance rules was regarded by many as something beneath the dignity of the Institute. It has been so expressed; it has been so treated. But I think that as the thing has taken shape it is clear to all the members that it is essential that this Institute take some definite action. (Applause).

On invitation Mr. C. J. H. Woodbury, said: I came here this evening as a guest and to listen, not expecting to take any part in debate. My former position for a number of years was in technical relation to underwriters of manufacturing property, and I had occasion to have an intimate knowledge of the policy of the insurance companies in regard to electric light and power installation, and as that is now with me something of the past, I can perhaps look at the subject from a disinterested standpoint. There were a great many electric lighting rules, so called, made by local bodies of underwriters, at times conflicting bodies. In 1893, shortly after the last issuance of the rules of the National Electric Light Association, there was formed in Chicago what was known as the Underwriters' International Electric Association, the name of which has since been modified by the change of International to National. Suffice it to say that they adopted a set of rules which were in most respects along the lines of those of the National Electric Light Association. There were, however, some points of difference and these rules have had several amendments which have been prepared and promulgated from time to time. Two months ago I had occasion to make definite inquiries throughout this country in regard to these electric lighting rules. I found that whereas the rules of the Underwriters' National Electric Association are at the present time very generally adopted, yet there is a great difference in their promulgation and enforcement, and that is a difficulty which seemed to be an inevitable one in the early stages of the work, but will grow less and less pronounced as time goes on, because the insurance companies will have a better trained set of

men. At the meeting of the National Electric Light Association I had some unofficial assurances which I was able to present to the committee, and they made a report which has been received with a great deal of favor in insurance corporatoins. At the present time the affairs of the National Electric Underwriters' Association on the subject of these rules are in exceedingly good and competent hands. The chairman of the Electrical Committee is a member of this Institute, an electrician of accomplishments and standing and one who in addition to his technical education has had a very extended practical experience in electric lighting and in telephony and telegraphy. All of these parties perceived the necessity of certain amendments and also the necessity of a unification of the whole set of rules, because this question of the function of these rules is not one which can be subdivided and separated one part from another by any line of demarcation. It begins with the design and extends to the construction, the installation and the maintenance of all electrical apparatus of whatsoever kind or nature, whether it uses all these quantities of energy which can be converted into heat sufficient to cause a fire, or whether it pertains to the inherently harmless instruments, from battery circuits, but which may be and are, in certain conditions, a possible source of danger by reason of their exposure to the heavier currents used in lighting and power. These questions are fully recognized, and can be treated in only one way, and that is by a conference representing all of the various tributary interests. I am sure that the underwriters are alive to it, and that they aim towards that end, because I judge from their representations to me to the extent to which I represent one of these interests of electricity in this matter. I am looking forward to a conference which will occur in the immediate future representing, I do not care under what head, all of these various electrical interests, and which will result in the unification of the electric lighting rules, and it is through that means and through that means alone that such a result can be obtained. It should be conceded that it will take time for the training and development and selection of persons competent to enforce these rules adequately and justly. (Applause).

The secretary then read a letter from Mr. Fremont Wilson (who was absent on account of illness), in which the latter gentlemen said:

"If Professor Anthony's paper is discussed, I hope it will be deemed of enough importance to have a committee of five appointed and a resolution passed, and a letter sent to the New York Board of Fire Underwriters, requesting the privilege of the audience of our committee to appear before the New York Board in relation to the non-observance of standard rules, etc., and to prove to the representatives of the New York Board the injury they are doing to the electric light and power interests throughout the country, by the peculiar methods that have been in vogue for the last two or three years.

Mr. Hammer:—I would like to suggest, as it has been stated here to-night, that the matter is already in the hands of the National Electric Light Association, and that their committee will extend an invitation to the Institute of Electrical Engineers, as well as representatives of the other interests, and that the matter will then be taken up, not dealing with specific cases, but with the whole thing in a broad-gauge way. While we may move a little bit more slowly in that way, I think perhaps by joint action, going about it thoroughly, we will accomplish more than by having the Institute refer the matter to a committee in the way proposed.

Mr. Mailloux:—I agree with Mr. Hammer that the matter ought to receive more deliberation before we act. At the same time, I feel that there ought to be a committee representing the American Institute of Electrical Engineers on the subject. I also feel that further discussion ought to be had on the subject. I think there are others who would be present at another meeting, perhaps, who would be able to contribute to the discussion. This subject is too important, and it is of too much interest, not only for the welfare of the Society, but for the individual welfare of its members, to be passed over lightly. So far as the appointment of a committee is concerned, I would be willing to leave that to the Council. I think the Council is competent to appoint such a committee and to give it proper constitution, but I think the whole matter might be well laid over to the next meeting. I would make a motion to that effect.

The motion was carried.

THE BLACKENING OF INCANDESCENT LAMPS.

G. Tolomer, of Rome, has made a study of the condition of lamp filaments before and after use. He has carefully examined them under a microscope of 850 diameters, and likewise examined the film deposited in the glass bulb. In a recent issue of *L'Elettricita*, of Rome, the results of these interesting investigations are reported and reprinted in the London *Electrical Review*.

The appearance presented by an unused carbon is a regularly undulating surface. A used filament, however, has its surface covered with little humps resembling in miniature those on the carbons of electric arcs. These humps seem to have been produced by some melted material. Near the point of fracture, and often elsewhere, the filament seems to the naked eye to be covered with lampblack. At such parts, and particularly near the break, the filament appears under the microscope to be furrowed by transverse cavities like craters, out of which rise ramifications of lampblack which have the appearance of volcanic jets.

On examining the film of a blackened lamp bulb, the deposit is found to be much deeper opposite the point of breakage than in other parts. "This shows that the cause of the breaking is the same which produces the blackening of the glass, and is connected with the development of some gaseous substance from the carbon." The theory which has been held by some, that blackening results from the transference of carbon chemically by means of residual carbonic oxide, is thus proved to be incorrect. The hypothesis that a sublimation of carbon occurs, like that obtained by Moissan with the electric arc, is also untenable, for such a phenomenon could not give rise to the ramifications referred to The microscopic examination of the film displays a very thin coating of lampblack in which it is easy to distinguish some larger grains irregularly distributed. "These grains are often assembled into strange shapes, and may be considered as thrown off from the filament, which have adhered to the glass. Among such fragments I have noticed the presence of some yellowish crystals of very different sizes. Owing to the exceptional transparency of such crystals, it was impossible for me to measure the angles of their faces. All the crystals may be easily detached from the glass, and appear quite like those of olivine. I do not attempt to prove their identity with this compound, but am certain that they are formed of a substance produced in the filament, and sublimated, owing to the high temperature."

From these observations the author concludes that the destruction of filaments is brought about somewhat in the following manner: Certain mineral substances contained in the carbon become fused by the high temperature, and owing to the evaporation of these substances, the carbon undergoes a gradual disintegration, some very minute particles of carbon being projected on to the glass. When the explosions of the little humps present on the surface are at all violent, entire fragments are detached, and at those places where detachment occurs, most frequently the filament finally fractures.

The article concludes as follows: "I have also undertaken a chemical examination of the filament and of the substance deposed on the bulbs; although this examination is by no means completed, it enables me to state that something other than carbon leaves the filament during the life of the lamps, and it constitutes the principal cause of its disintegration, and of the consequent blackening of the bulb."

"THE PROJECTORS OF THE ATLANTIC CABLE."

An interesting event took place at a special meeting of the Chamber of Commerce in this city on the afternoon of May 23. Three hundred and fifty members and many ladies were present, the occasion being the presentation to the Chamber of Commerce of the painting "The Projectors of the Atlantic Cable." The donors were 52 of New York's leading citizens, including George J. Gould, and General Thomas T. Eckert of the Western Union Telegraph Company, John D. Crimmins, and many other equally well-known persons.

A letter from Associate Justice Field of the United States Supreme Court was read, of which the following is a copy:

SUPREME COURT OF THE UNITED STATES,
WASHINGTON, D. C., May 20, 1895.

To the Chamber of Commerce of New York:

GENTLEMEN: I have to acknowledge your kind invitation to be present at the unveiling of the painting of the projectors of the Atlantic cable. Few subjects are more worthy of the genius of the artist or the historian. When Columbus discovered the New World it was almost as far away from the Old World as if it had been in another planet. Improvements in the art of navigation brought the continents nearer to each other, but it was reserved to modern science to make it possible to have instantaneous communication. The mere conception was almost a divine inspiration, but to carry it into execution was the work of twelve laborious years—years interrupted by defeats and disappointments that would have broken down the courage of most men. All this I had reason to know from my relation to one who took such a part in the enterprise, and hence I should be with you on an occasion of so much interest but that it comes in the very last week of the court. You need, however, no individual presence. The great painting before you speaks for itself. The faces there portrayed are familiar to the people of New York as among those of their most honored citizens. All of them are now gone from the world, but the remembrance of what they did may well be a matter of pride to their children, and it is fitting that this historic scene should be put on canvas by your distinguished artist and placed in the great hall of your Chamber of Commerce to preserve the memory of it to future generations. I am, with great respect, yours very sincerely, STEPHEN J. FIELD.

The painting represents a meeting of the Atlantic cable projectors at the residence of Cyrus W. Field in Gramercy Park. Peter Cooper is presiding. Mr. Field is calling attention to a chart of Trinity Bay, pointing to Heart's Content as a safe harbor for landing the cable. David Dudley Field stands by the President with a law book. Chandler White is handing estimates of expense to Marshall O. Roberts; next to whom, at the table, is Moses Taylor. At the end of the table stands Wilson G. Hunt. Prof. Samuel F. B. Morse is standing behind Mr. Roberts, and by his side the artist, sketching.

The canvas is 7 feet by 9. Its cost was $20,000, and that of the frame $500 more.

PURDUE UNIVERSITY.

We have received a copy of the Annual (1894–95) Catalogue of Purdue University, of Lafayette, Ind. The institution embraces six special schools, as follows: A school of Mechanical Engineering; a school of Civil Engineering; a school of Electrical Engineering; a school of Agriculture; a school of Science, and a school of Pharmacy.

The school of Electrical Engineering includes shop practice, machine design, electrical engineering, dynamo construction, installation and management of electric railway and lighting plants.

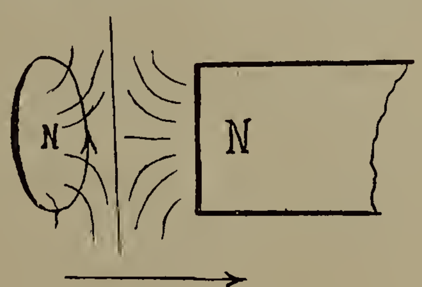
PRINCIPLES OF DYNAMO DESIGN.

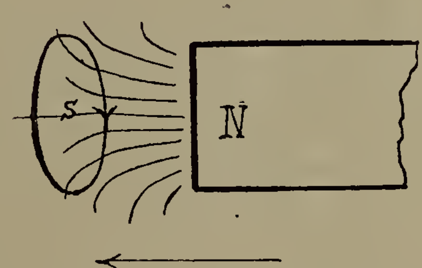
BY

Newton Harrison, E.E.

(*Continued from Page* 294.)

When a coil of wire approaches the pole of a magnet a casual observer would not be led to expect any unusual experience, but if the coil composes a closed circuit, a most remarkable resistance will be felt for any sudden movement of the coil; and in fact if the coil be carried forward so as to enclose the pole within itself, the same peculiar retardation will be again experienced when the attempt be made to suddenly remove the coil. The main point of interest in this phenomenon is the fact that the only thing tending to oppose the movement forward in the first case or away in the second case, is a strong magnetic reaction. In other words, the direction of current in the coil when the pole is introduced within it is such as to oppose its motion, and as such must be productive of a similar polarity to that end of the bar magnet in its proximity; otherwise repulsion could not ensue. The converse would be true when the coil is suddenly pulled from the





magnet or the magnet from the coil; that is to say: the removal of a coil from a magnetic pole starts a current in the coil tending to attract the pole, which must therefore be of opposite polarity. By thus realizing the existence of a repulsive tendency upon approach and a retarding tendency when leaving, the necessary direction of the currents induced in either case becomes known. The last given rule works in perfect harmony with these facts, *i. e.*, the rule of the right hand—(the thumb held vertically, showing the direction of motion, the forefinger held horizontally, indicating the direction of the lines of force, and the second finger at right angles to the first, showing the direction of the induced current). The explanation of the four cases given is therefore answered as follows (see diagram):

(1.) When a coil approaches a north pole the induced current flows in such a direction that a north pole is produced in the nearest end of the coil.

(2.) When a coil recedes from a north pole the induced current flows in such a direction that a south pole is produced in the nearest end of the coil.

(3.) A coil approaching a south pole has a south pole produced in its nearest end.

(4.) When the coil leaves the south pole it has a north pole induced in its nearest end.

It is therefore possible to create a reversal of current by simply reversing the motion of the coil.

It is very interesting to note this fact, because it shows the intimate relations existing between direction of current and direction of motion. If the movement of a wire in a given direction past a north pole starts a current in a given direction, then the movement of the wire in an opposite direction past the lines of force of the north pole will create a current flow *whose direction will be the same as that due to the movement of the wire past a south pole.* To form a physical idea of this action it is necessary to remember the fact that whenever a current flows in a wire its presence is attended by little magnetic whirls around the wire which also have a direction of rotation. If the current is reversed in direction, the magnetic whirls will also reverse and rotate around the wire in an opposite direction. Thus it seems that the two have definite relations existing between them. If such be the case it is only necessary to produce these whirls in either direction around the wire in order to start a current flowing corresponding to them An illustration of the relationship between the two is indicated by the following fact. When the current flows in the direction of the hands of a watch in the end of a coil facing us the magnetic whirls are rotating so as to pass inward at that end and therefore producing a south pole; but if the current is reversed so as to flow against the direction of the hands of a watch, the magnetic whirls also reverse and the polarity becomes north. If therefore lines of force be considered as being perfectly elastic and thoroughly flexible rods, a stiff bar suddenly striking them will cause them to entwine it either in one direction or another, according to the direction in which the bar moves. The whirls are therefore set into activity and induce the correspondence with their direction, a current flowing either way.

The above will supply at least a rough analogy of some little help in clearing up preconceived notions of a false character.

(*To be Continued.*)

PHOTOGRAPHS OF LIGHTNING.

Mr. J. N. Jennings, of Philadelphia, and of the Philadelphia Photographic Society, recently gave an interesting exhibition of views of lightning before the Society of Amateur Photographers in New York city, which proved in his estimation that the artists' conception of lightning, as depicted by them, was wholly wrong. He had illustrations of the earliest ideas of lightning gathered from the records of the ancients; lightning as the Western Indians sketched it; a comparison of the discharge of electricity over the surface of a dry plate, between the two terminals of a Holtz electrical machine, with the appearance of iron filings on a piece of glass or paper as arranged between the two poles of a magnet when the latter is placed under the paper, and a comparison of a heavy discharge spark from such machine with an ordinary lightning flash. A photograph of a silver dollar laid on the surface of a dry plate and illuminated by the faint discharge of electricity about it was very novel.

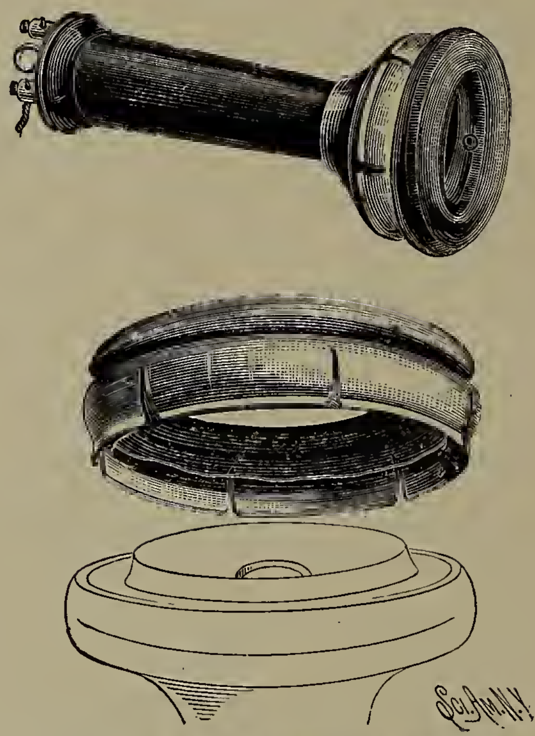
Other pictures represented the curious tree-like appearance of lightning, and the dark branches or black branches seen to emanate from the side of the stroke. Mr. Jennings stated that when the picture was made he observed, at the time of the flash, these branches had the appearance of a deep orange color, which accounts for the phenomenon of their taking black on the sensitive plate. A peculiar phase of a single flash, separating into two branches going in the same direction downward, the path of one being further off than the other, on account of the lateral action of the wind, was shown. There were views of veritable thunderbolts, where two separate flashes run into each other. Also views of flashes shooting upward from the earth. He showed a comparison between a sheet of glass cracked by heat with the form of a lightning flash, and closed the series by showing a view of a flash taken from the rear end of a railway train in motion, which had the appearance of a broad ribbon of light—very remarkable. He proved that it could not have been due to the local movement of the camera, but gave us a possible explanation that it might have been produced because of a single stroke separating it into two parallel branches near together, one nearly back of the other, which would make the light from each merge on the plate and give the effect af a broad ribbon of light.

The views were very instructive, in showing the many phases of lightning and in correcting false ideas on the subject. Photographers generally should be prepared to catch views of lightning in order that it may be studied photographically as effectively as astronomy is now done.

THE LATEST AND IMPROVED AIR CUSHION FOR TELEPHONE RECEIVERS.

A very handy attachment for the telephone is the pneumatic cushion ear-piece, illustrated herewith. This device is made of pure, soft gum rubber, fitted into a metal rim that springs or clamps over the end of any telephone receiver.

This cushion neutralizes the disagreeable sounds produced in the telephone by the induction, and the buzzing and clucking sounds so common in this instrument. It



AIR CUSHION FOR TELEPHONE RECEIVERS.

also makes the touch to the ear soft and pleasant, and regulates the distance from the diaphragm to the ear-drum. It is said that this cushion improves the hearing 50 per cent., besides shutting out all extraneous noise.

The unpleasant suction caused by pressing the cushion to the ear is overcome by a small tube in the inflated part of the cushion. This tube lets out the air from between ear and the receiver, but on account of its being so small no sound can enter.

The objection of having the ear removed so far from the diaphragm has been overcome by making the cushion large enough to entirely enclose the ear, thus giving it the essential quality of a sound-proof booth.

This valuable device is being put upon the market by Mr. C. Maynard Evans, 108 A, World Building, New York City.

ELECTRIC MEDICAMENTAL DIFFUSION.

This is the title of a paper read by Dr. W. J. Morton, of New York, at the fourth annual meeting of the American Electro-Therapeutic Association, in New York, September 26–27, 1894. The paper is reprinted in pamphlet form from the *Journal of the American Medical Association*, by the American Medical Association Press, Chicago.

Plant Operated By Electric Power—The Stupp Bros. Bridge and Iron Co., of St. Louis, after a successful trial of electricity as a motive power, has permanently adopted it to operate its plant.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS.

The 14th annual meeting of the Association of Railway Telegraph Superintendents will be held at Montreal, Que., June 12 and 13 next, at the Windsor Hotel.

Papers will be read on the following named subjects: Remedies for Inductive Disturbances in Telephone and Telegraph Lines, by Thomas D. Lockwood, of Boston; Practice of Placing Responsibility on the Young and Inexperienced, by Ralph W. Pope; Trolley Currents and Automatic Signals, by G. H. Thayer; The Michigan Central System and its Operators, by E. E. Torrey, of Detroit; Standard Construction of Telegraph Lines, by W. F. Taylor; Line Construction, by C. A. Parker; Uniformity, by J. C. Ford; Some Suggestions on the Social and Moral Conditions of Railway Telegraphers, by R. B. Gemmell; Evolution, by J. Q. Mason; Water-Power in Connection with Electricity and Electric Locomotives in Railroading, by J. J. Burns.

The officers of the association are O. C. Greene, President; M. B. Leonard, Vice-President; P. W. Drew, Secretary and Treasurer.

THE NEWEST SWITCH.

Mr. G. W. Russell, Jr., E. E., of Denver, Col., was met by a representative of the Electrical Age in the office of Godfrey, Harrington & Olsen, 15 Cortlandt street, last Tuesday. Mr. Russell has with him an automatic switch of his own invention. It is operated by simple multiple electric gas-keys. Two multiple solenoids face each other, the core passing through both. On pushing the gas-key the current energizes the solenoids, to the core of which is attached a metal cross-arm carrying the blades of a switch, and as the core passes in and out of the solenoid the switch is opened or closed, according to connection. The switch is set in a glass-covered walnut box with slate base, the box being 7x4 inches square and 3 inches deep. Mr. Russell operated the switch with an ordinary window burglar-alarm switch, and it worked perfectly. The principal feature of the switch is that it can be operated from any distant point by means of a push-button or gas-key.

Mr. C. O. Mailloux has seen the switch, and was very favorably impressed with it. He says he will use it in some of his finest electric light installations.

FLEXIBILITY OF USE OF THE ELECTRIC LAMP.

The ease with which the incandescent lamp can be controlled, its comparative coolness and its ready adaptability to any position have been taken advantage of to produce many striking and beautiful decorative effects. There are great artificial wreaths and bouquets with little lamps half hidden along the leaves and flowers. Then there are spirals and curiously intricate patterns made of many colored lamps, which are controlled by revolving switches connected to electric motors, and as the different sets of lamps are cut in and out the most brilliant kaleidoscopic effects are shown. Clock faces, with shining figures, and windmills with fiery arms are to be seen, while perhaps most striking of all is a large American flag, on which the lamps are so arranged that as the controlling switch revolves, vertical lines of light and shade chase each other rapidly from end to end of the field, and the Stars and Stripes wave proudly in the breeze.

Some idea of the magnitude of the incandescent lamp industry may be gathered from the fact that the principal factory in the business in the United States turns out, on an average, about twenty-five thousand lamps per day, and has a capacity of thirty thousand. Ninety per cent. of these are of the ordinary size—sixteen candle-power—and the remaining ten per cent. are principally of smaller size, the larger lamps not cutting a great figure in the art. In the early days of the industry it required six watts to maintain one candle-power of light, and, therefore, making allowances for losses in the dynamo and on the line, one horse-power, which is equal to 746 watts, delivered to the dynamo shaft could keep only about six sixteen-candle-power lamps going. Today the best lamps consume not more than three watts per candle. and one horse-power will run 13 or 14 ordinary lights.

ELECTRIC RAILWAYS IN JAPAN.

The Kyoto Electric Railway, the first in Japan, was opened to the public on March 21.

An electric road is to be built between Kobe and Amagasaki, Japan, a distance of 15 miles. The line will ultimately be extended to Osaka.

An electric railway will be built from the railroad station to the exhibition buildings in Kyoto. The exhibition will be held this year, and will include electrical appliances manufactured in Japan by natives.

New Books.

Electrical Engineers' and Students' Chart and Handbook of the Brush Arc-Light System. By H. C. Reagan, jr. Norman W. Henley & Co., New York. Price, $1.

The object of this book is to give those connected with the Brush system of dynamos a clear and simple explanation and illustrations of the different parts of the dynamo.

As a work of reference it will be found valuable to the student who is fitting himself for an electrical engineer, as well as to the engineer in charge of a Brush station, also his assistants. Every action of the dynamo is clearly illustrated and every detail of construction is likewise shown. The illustrations for the most part are original, and so simple and clear that anyone with ordinary intelligence cannot fail to become so familiar with the Brush machine as to be master of it in theory and practice.

A valuable feature of the work is the revolvable celluloid chart, which comes with each copy of the book. This chart represents a Brush dynamo with a revolvable armature. It shows the manner of cutting the lines of force, the directions of the flow of current induced in the armature coils; the method of commuting the current; the flow of current to the external circuit and return to the negative brush. The action of the chart is the same as a *real Brush dynamo.*

The work also contains the very latest data on the Brush system of arc-light dynamos, giving the numbers, capacity and standard dimensions of H. P. required for each dynamo, etc., etc, and the book has been approved by the Brush Company.

This book is of sufficient interest and value to entitle it to a large sale, notwithstanding its limited scope. The Brush arc-light system is nowhere so clearly described and illustrated, and for this reason alone the book should be read and studied by all connected with electricity in order to become familiar with this interesting system. It will be of special value as a work of reference in Brush stations.

GENERAL MEETING OE THE A. I. E. E. AT NIAGARA FALLS.

The council of the American Institute of Electrical Engineers, on May 21, decided that the general meeting of the Institute shall be held at Niagara Falls June 25 to 28 inclusive.

PERSONAL.

Mr. Charles Foster has accepted the position of mechanical and Electrical Engineer for the Cotton States and International Exposition, Atlanta, Ga. Mr. Foster was one of the mechanical engineers at the World's Fair.

THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

At the annual meeting of this Institute, held in New York May 21, the council reported a membership of 944, showing a net gain of 144 members during the year ending April 30, 1895.

At the meeting of the council in the afternoon the following named persons were elected associate members:

Andrews, William C., Brooklyn, N. Y.

Beames, Clare F., General Electric Company, Schenectady, N. Y.

Canfield, Myron E., Western Electric Company, New York City.

Dewar, John Thomas, Western Electric Company, Antwerp, Belgium.

Gharky, William David, superintendent underground cable construction and maintenance, Philadelphia Traction Company, Philadelphia, Pa.

Henderson, Henry Banks, Ithaca, N. Y.

Hogentoren, Sydney, electrical expert, the Varley Duplex Magnet Company, New York.

Jackson, Theodore K., Hyde Park Electric Light and Power Company, Chicago, Ill.

Roller, Frank W., electrical engineer, 203 Broadway, N. Y.

Simpson, Alexander P., New York Electrical Equipment Company, N. Y. City.

Wilcox, Norman T., manager and electrician, Seneca Light and Power Company, Seneca Falls, N. Y.

The following associate members were transferred to full membership:

Romaine Callender, electrician, Decker building, New York City.

J. Day Flack, electrical engineer, 252 West Eighty-fifth street, New York City.

F. Colvin, president Interior Telephone Company, 203 Broadway, New York City.

Russell Robb, with Stone & Webster, 4 Post Office square, Boston.

V. M. Berthold, American Bell Telephone, 125 Milk street, Boston.

Herbert Lloyd, general manager, electrical engineer and chemist, the Electric Storage Battery Company, Drexel building, Philadelphia, Pa.

Harry Hartwell Blades, general superintendent, the Detroit Motor Company, 1343 Cass avenue, Detroit, Mich.

In the evening the discussion of Professor Anthony's paper on "Underwriters' Rules," read on April 17, was resumed, and opened by Professor W. L. Puffer, of Boston.

THE EDISON COMPANY IN BROOKLYN GOBBLES UP THE CITIZENS' COMPANY.

Last week the control of the Citizens' Electric Illuminating Company, of Brooklyn, passed into the hands of the Edison Electric Illuminating Company, of the same city.

Negotiations for the purchase of controlling interest in the company were begun a few weeks ago, through a committee representing the Edison company. The market price of the Citizens' stock was 125, but the Edison Company, it is reported, paid 160 in order to carry out its plans.

The Edison Company will not assume control of the Citizens' Company until July 1, next. It is understood that each company will retain its own corporate existence.

The Edison Company, it is reported, will reduce the price of public electric lights.

Three-Phase Dynamo.—Siemens & Halske, of Berlin, have the contract to supply a three-phase alternating current dynamo for the Kyoto Canal office, Japan.

New York Notes.

Office of the Electrical Age,
World Building, New York,
May 27, 1895.

Mr. P. C. Oscanyan, an old and well-known electrician, now represents the Cross Engine Co., 126 Liberty street, New York.

John C. Dolph has been appointed manager of the Eastern District for the Forest City Electric Works, Cleveland, Ohio. Mr. Dolph's office is at 126 Liberty street.

Mr. Harry M. Shaw, 126 Liberty street, New York, has been appointed manager of the New York office of the Eureka Tempered Copper Co., of North East, Pa. The Eureka Co. is to be congratulated on their good fortune in securing so able a gentleman as their representative. Mr. Shaw is widely and favorably known in the trade.

Mr. A. M. Johnson, the New York representative of Moore & Wyman, manufacturers of electric and power elevators, has a fine office at 126 Liberty street. Mr. Johnson lately assumed the management of the New York office and is meeting with merited success. He has had a wide experience in this line and has the knack of ferreting out buyers.

At the last meeting of the Directors of the Brooklyn Electric Manufacturing Company, 351 Jay street, Brooklyn, Mr. George A. Mullen was elected secretary and treasurer, and Mr. Louis Wintner, General Manager. Mr. Mullen has been connected with the company for nearly a year, and under his management the business has in that time increased ten-fold. This company is said to be the largest builders of switchboards in the United States.

The Lenox Avenue underground conduit electric road was put into regular operation on the morning of May 22. The entire line is not yet ready, the cars running only to 116th steeet and Eighth avenue. In about two weeks work will be finished on the rest of the line. The new cars are exact counterparts of the Broadway cable cars, both as to size and color. They were made by the John Stephenson Co. and are handsome specimens of street car construction. They have run with ease from the start, and not a single hitch of any sort has occurred. Their appearance excited considerable interest and they have been well patronized. The line complete runs from 146th street and Lenox avenue to 110th street and Columbus avenue, at which point passengers will be transferred to the Columbus avenue cable cars.

More trouble is threatened between the Electrical Contractors' Association of this city and the Board of Walking Delegates. Since the settlement of the last strike, non-union electrical workers have been employed on the American Tract Society building at Nassau and Spruce streets by the Tucker Electrical Construction Company. Non-union men are said to be at work also on other buildings. The Board of Walking Delegates sent a letter to the Electrical Contractors' Association a few days ago stating that under the terms of the settlement only union men could be employed. A reply from the Electrical Contractors' Association was read at the meeting of the Board of Walking Delegates stating that in their opinion the settlement of the strike called for the protection of the non-union men who were at work when the strike was settled. The Board decided that under the terms of settlement the non-union men ought to be discharged. The Electrical Workers' Union was notified of this, and if that organization orders a strike the Board is ready to call the other trades out in sympathy.

W. T. H.

Street Railway Notes.

The Consolidated Street Railway Co., Macon, Ga., intends to enlarge its electric light and power systems.

The Consumers' Light and Railway Co., Tampa, Fla., contemplates building a railway line from Tampa to Palmetto Beach.

The Broderick & Bascom Rope Co., of St. Louis, is making a wire cable for the extension of the Broadway cable line, New York city, which will be 34,000 feet long and weigh 70 tons.

Some time in June the Board of Aldermen, of New York, will conduct a series of practical tests, with the view of determining the value of street car fenders. All sorts of fenders will be tried. The tests will continue for 90 days or more.

The plans submitted by the Rapid Transit Commissioners to the Board of Aldermen, New York, were approved by the Council on May 22. Only two votes were cast against the scheme.

On May 20 Henry C. Payne and George R. Sheldon were appointed receivers of the Milwaukee Street Railway Company, Milwaukee, Wis. Over nine-tenths of the bondholders assented to an agreement to place the property in the hands of a receiver, for the purpose of effecting a reorganization. Mr. Sheldon is of New York. The Milwaukee Street Railway Company's system comprises 135 miles of track.

An electric road is to be built between Dublin and Souderton, Pa., a distance of eight miles.

Ellery Stebbins, Francis Tasker and others, Clinton, N. Y., are interested in the proposed electric road, which is to be built from Clinton to New Hartford, connecting with the Utica Belt Line road.

A committee of three, representing the employés of the Atlantic Avenue Trolley Company in Brooklyn, called upon Superintendent Quinn on Wednesday of last week, and protested against putting any more "trippers" on the lines. Mr. Quinn, it is reported, told the committee that the company intended to run its cars to suit itself and the public, and that it would listen to no suggestions from the men. It is stated that he discharged two members of the committee for indulging in abusive language and suspended the other.

Municipal Ownership.—There is an English law which limits the duration of street car line charters to twenty-one years. It was passed in 1870. Many of the charters are, therefore, already expiring. When they expire, the law provides that the city through which the lines run may buy them or lease them and operate them under municipal authority. There is a general movement on the part of the cities to take possession of the lines. In Glasgow, Manchester and Birmingham, as well as in a number of smaller places, the street car lines are already owned and operated by the city. In these cities the results have been all that could be desired so far.—*Washington Star.*

How to Compute the License for Cars.—An ordinance proposed in Chicago, granting a charter to The Calumet Electric Street Railway Company, contains the following clause: "The said Calumet Electric Street Railway Company shall pay into the City Treasury of the City of Chicago, for the use of said city, the sum of fifty ($50.00) dollars and no more, as an annual license fee for each and every car used by said company. In computing the number of cars upon which such license charge may be imposed, thirteen (13) round trips, when one car is used in transportation of passengers, shall be taken as equivalent to one day's use of one car. One-thirteenth of such round trips, during each quarter, shall be divided by the number of days in such quarter. Such quotient shall be the number of cars subject to such license fee. The President, or other chief officer of said company. shall under oath make report quarter-yearly to the Controller of the City of Chicago, of the whole number of cars run by said company, and at the same time pay to said controller twelve dollars and fifty cents for each car, to be ascertained as above prescribed in this section. The first quarter shall begin upon the first day upon which the company shall run a car for the carriage of passengers."

The St. Louis *Globe-Democrat* says: Railway building in this city this year promises well. Over fifty miles of new tracks are planned in the shape of new lines, extensions and changing over. It can be said that many sections of the streets will be torn up during the spring and summer by road builders. St. Louis is getting pretty well gridironed in this respect, which is a sign of prosperity, if the railway men, the real estate dealers and capitalists are to be believed. It is an acknowledged fact that this city took the lead in rapid transit from the start and has kept it up ever since. Other large cities have looked upon the overhead trolley with some distrust, and thus, in a manner, fallen behind in the procession. The officials of this city and the Municipal Assembly have been less exacting with the companies, with the result of better accommodations and greater conveniences for the public. A year or two ago New York, Philadelphia, Brooklyn and Chicago relaxed some of their former rigid rules as to electric traction, and now the trolley lines are spreading in those cities. It has been found that nothing compares to the trolley, and that it is as safe as any system that can be devised. The street car with the pole on the roof is multiplying fast, while the prejudice against it is diminishing day by day.

Regarding the new rules governing the stopping of Brooklyn trolley cars on street corners, the *New York Tribune* says: Many Brooklyn people, especially women, have been surprised and confused by the antics of the trolley cars since the new rule regarding stops went into effect. The new ordinance governing the speed and stops of the cars require that the cars shall stop for passengers at the near crossing, being just the reverse of the old rule. In the long blocks of the uptown wards, stops may be made in the middle of the block, but where the cross streets are less than 300 feet apart, stops may not be made for passengers, except at the near crossings. This means that people bound downtown must board a car at the uptown crossing of an intersected street, while those bound uptown must board a car at the downtown crossing. The new rule is an excellent one, as the motorman has an opportunity of seeing that there are no people nor wagons in his path when crossing the streets. Those people who have been left, by persisting in remaining on the far crossing while the car rushed by, will know better next time, and as every car has a conspicuous notice explaining the new rule, those who ride may read and learn.

Telephone Notes.

The Home Mutual Telephone Co. has been organized in Little Rock, Ark., by W. J. Wilson, J. W. Shellhorn and M. H. Johnson. The business will be conducted on the co-operative principle.

The Florida Telephone and Construction Co., Tallahassee, Fla, has been organized, with a capital stock of $10,000. Geo. W. Saxon, W. A. Rawls and others are interested.

The Southwestern Telephone and Telegraph Company will build lines from Marlin, Texas, to all the important points in that State. The same company is to build a line

from Bremond to Waco, Texas, and is now at work on the line from Houston to Corsicana.

The City of New Orleans is about to award a franchise for a telephone system. The franchise is opened to all bidders. The Mayor can give further information.

The Pee-Dee Telephone Co., recently organized in Marion, S. C., will build a line from that place to Sellers, Latta and Dilion. Among those interested in the company are: Dr. J. H. David, D. M. Dew, John C. Sellers, E. H. Gasque and Henry Mullins.

The Norton-Troutburg Telephone Company, Albion, N. Y., proposes to extend its lines to Holley.

TELEPHONE PATENTS ISSUED MAY 21, 1895.

Microphone. Ernest J. P. Mercadier and Joseph M. Anizan, Paris, France. (No. 539,437.)

Telephone Call. Frederick J. Troll, Washington, D. C. (No. 539,712.)

The Telephone in Japan.—The transfer of the telephone service in Japan from State to private control has been recommended to the Diet.

New Corporations.

La Crosse, Black River Falls and Neillsville Electric Railway Company, La Crosse, Wis., by Nathan Clark, Paul McHugh, William H. Polleys, T. J. McHugh, William Burn, to operate an electric railway for the carriage of passengers, mail, freight, express, between La Crosse, Black River Falls and Neillsville. Capital stock, $300,000.

The Shelby Electric Railway Company, Shelby, Ohio, by S. S. Bloom, Albert Moore, G. D. Geilelen, C. S. Holbrook, F. A. Abbott, J. W. Williams. Capital stock, $10,000.

The Smithville Water and Light Company, Smithville, Tex., by K. H. McDonald and others. Capital stock, $400,000.

The Mammoth Springs Electric Light Company, Mammoth Springs, Ark., by H. G. Kings and others. Capital stock, $100,000.

The United States Telephone Construction Company, Camden, N. J., with a capital stock of $50,000.

The New York and Philadelphia Telegraph and Telephone Company, Newark, N. J., by E. P. Meaney, of Newark; M. Eggleson, of Elizabeth, and A. E. Holcombe, of New York, to erect telegraph and telephone wires from New York to Philadelphia. Capital stock, $15,000.

The Big Four Electric Company, Chicago, Ill., by William H. Brown, Louis K. Gibson and Henry D. Ames. Capital stock, $200,000.

The Sullivan County Telephone Company, Albany, N. Y. Capital, $5,000; directors, Charles Homer, William H. Lawrence, and Edward Homer, of Jeffersonville.

The Orange County Telephone Company, to operate in Middletown and other sections of Orange county, N. Y. Capital, $10,000; directors Lewis S. Stivers, John E. Iseman, Albert B. Wilbur, Frank M. Stratton, and others of Middletown.

The Texas Electric Co., Austin, Tex., by C. W. Hobson and others. Capital stock, $5,000.

Lancaster Water, Light & Ice Co., Lancaster, Texas, by R. P. Henry, S. L. Randlett and others. Capital stock, $15,000.

The Newtown Light, Heat & Power Company, Newtown, Queens Co., Long Island, N. Y., by J. C. Smith, of Babylon; Francis McKenna and George S. Jervis, of Maspeth, and others. Capital stock, $20,000.

Syracuse & Oneida Lake Electric Railroad Company, Syracuse, N. Y., by Hiram McGonegal, New York; W. S. Wales, W. B. Kirk, J. B. Morgan, James N. McCormack, and William E. Wheeton. Capital stock, $300,000.

The Lancaster Water, Light & Ice Company, Lancaster, Tex., by R. P. Henry, S. L. Randlett, W. A. Strain, F. M. Hammond, W. L. White and others. Capital stock, $15,000.

The Moravia Electric Power Company, Los Angeles, Cal., by U. N. Monroe, C. T. Dorland, J. H. Partle, Moravia, H. V. Carter and J. F. Sartori, of Los Angeles. Capital stock, $100,000.

Possible Contracts.

The Fate-Gunsaullus Co., Plymouth, Ohio, will probably install an electric light plant.

A popular vote will be taken in Jackson, Tenn., on August 22, on the question of issuing bonds for an electric light plant. The Mayor of Jackson can give further information.

Mayor D. F. F. Randolph, of Salem, W. Va., can give information regarding the proposed electric light plant in that place.

The Mayor of Darien, Ga., can give particulars regarding the proposed electric light and water-works plant in that place.

THE WADDELL-ENTZ COMPANY'S PROPERTY SOLD.

The plant and stock of the Waddell-Entz Co. were sold at auction in Bridgeport, Conn., on May 22. Mr. Percival Knauth, of New York, bought in the property, paying therefor $60,000. The effects disposed of in this sale consisted of letters-patent in France, Germany, Canada and Belgium on the company's storage battery, also the tools and machinery in the plant at Bridgeport, and the Second avenue street car line equipment in New York City.

SEALED PROPOSALS.

The city clerk, El Paso, Tex., will receive sealed proposals, until Aug. 2, for lighting the streets of the city by electricity for a term of five years, from Dec. 1. Not less than 50 lights to be furnished, and as many more as the City Council may order.

The Athens State Hospital, Athens, Ohio, is inviting sealed proposals, until June 20, for a complete electric lighting plant for that institution.

The city council, Dodgeville, Wis., will advertise for bids for lighting the city by electricity. A committee has been appointed to prepare specifications.

A BIG BARGAIN.

John B. Perry, 475 Tremont street, Boston, has 200 Bijou motors, new and in A1 order, which he will sell at less than cost to manufacture.

One hundred and seventy of them are wound for 110 volts, and thirty are battery motors wound to run on 16 volts. The Bijou motor is noted for its noiseless running of fans and sewing machines. The lot will be sold at a figure that will enable any one to sell the machines at a price 25 per cent. less than the cost to manufacture.

Trade Notes.

The Portable Fire Hose Bridge, for which the Metropolitan Electric Company, 186-188 Fifth avenue, Chicago, are general agents, is meeting with the approval of the electric street railways. This company has already received orders from several roads and is constantly receiving inquiries. The company reports a very good demand for its well-known P. & B. products. Its numerous street railway customers express themselves as being well satisfied with results obtained from the use of P. & B. tape and compounds. The Metropolitan Electric Company, Chicago, wish to inform the trade that they are now in a position to fill orders from stock for the well and favorably known Solar Arc Lamp for incandescent circuits.

WOVEN WIRE BRUSHES.

The Belknap Motor Co., of Portland, Maine, are the patentees and manufacturers of the best woven wire commutator brush on the market.

Electrical and Street Railway Patents.

Issued May 21, 1895.

539,404. Regulating Alternating-Current Induction Motors. Albert H. Armstrong, Schenectady, N. Y., assignor, by mesne assignments, to the General Electric Company, same place. Filed Dec. 5, 1894.

539,418. Conduit System for Electric Railways. Wilson H. Cotton, St. Louis, Mo. Filed Aug. 25, 1894.

539,431. Electric Bell. Francis G. Ingersoll, New York, N. Y., assignor to the Dewey Electric Signal Company, same place. Filed Oct. 26, 1894.

539,437. Microphone. Ernest J. P. Mercadier and Joseph M. Anizan, Paris, France. Filed June 3, 1893. Patented in France Dec. 9, 1892, No. 226,288; in Belgium Dec. 17, 1892, No. 102,597; in England May 3, 1893, No. 8,901.

539,440. Car Fender. Wilbur A. Peck, New Haven, Conn., assignor of one-half to Stephen R. Raynes, same place. Filed Jan. 29, 1895.

539,444. Emergency Rail-Brake. Enoch Prouty, Chicago, Ill. Filed March 21, 1895.

539,446. System of Electrical Distribution. Edwin W. Rice, Jr., Swampscott, assignor to the General Electric Company, Boston, Mass. Filed May 24, 1893.

539,450. System of Electrical Distribution. Charles P. Steinmetz, Schenectady, N. Y., assignor, by mesne assignments, to the General Electric Company, same place. Filed Dec. 20, 1894.

539,452. Electric Meter. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company, of New York. Filed Feb. 19, 1895.

539,453. Carbon Brush. Elihu Thomson, Swampscott, Mass., assignor, by mesne assignments, to the General Electric Company, Schenectady, N. Y. Filed Feb. 6, 1895.

(*Continued on Page* 316.)

National Electric Light and Street Railway Associations.

NATIONAL ELECTRIC LIGHT ASSOCIATION.

President, C. H. WILMERDING, Chicago, Ill.; 1st Vice-President, FREDERIC NICHOLLS, Toronto, Canada; 2d Vice-President, E. F. PECK, Brooklyn, N. Y. Members of Executive Committee: E. H. DAVIS, Williamsport, Pa, (one year); W. R. GARDINER, Pittsfield, Mass.; GEORGE A. REDMAN, Rochester, N. Y.; J. J. BURLEIGH, Camden, N. J. Next meeting, New York, May or June, 1896.

AMERICAN STREET RAILWAY ASSOCIATION.

Next meeting, Montreal, Que., October, 16, 17 and 18, 1895.

President, JOEL HURT, Atlanta, Ga.; Vice-President, W. WORTH BEAN, St., Joseph, Mich.; 2d Vice-President, JOHN M. CUNNINGHAM, Boston, Mass.; 3d Vice-President, Russell B. Harrison, Terre Haute, Ind., Secretary and Treasurer, WILLIAM J. RICHARDSON, Brooklyn, N. Y.; Executive Committee, HENRY C. PAYNE, Milwaukee, Wis.; W. H. JACKSON, Nashville, Tenn.; D. G. HAMILTON, St. Louis, Mo., C. C. CUNNINGHAM, Montreal, Canada; J. N. PARTRIDGE, Brooklyn, N. Y.

NEW YORK STATE STREET RAILWAY ASSOCIATION.

Next meeting, Albany, N. Y., third Tuesday in September, 1895.

President, G. TRACY ROGERS, Binghamton; First Vice-President, JOHN H. MOFFITT, Syracuse; Second Vice-President, W. W. COLE, Elmira; Secretary and Treasurer, WILLIAM J. RICHARDSON; Brooklyn; Executive Committee, D. B. HASBROUCK, New York; JOHN N. BECKLEY, Rochester; DANIEL F. LEWIS, Brooklyn.

OHIO STATE TRAMWAY ASSOCIATION.

Next meeting, fourth Wednesday in September, 1895.

President, ALBION E. LANG, Toledo; Vice-President, W. J. KELLY, Columbus; Secretary and Treasurer, J. B. HANNA, Cleveland; Chairman Executive Committee, W. A. LYNCH, Canton.

MASSACHUSETTS STATE STREET RAILWAY ASSOCIATION.

President, T. H. CUNNINGHAM, Boston; Secretary and Treasurer, A. S. BUTLER, Lawrence; Executive Committee, SAMUEL WINSLOW, ALFRED A. GLAZIER, Boston; P. F. SULLIVAN, Lowell; E. C. FOSTER, Revere; HORACE B. ROGERS, Brockton; A. E. SMITH, Springfield; PRENTISS CUMMINGS, Boston.

THE TEXAS STREET RAILWAY ASSOCIATION.

President, W. H. SINCLAIR, Galveston; vice-president, C. A. MCKINNEY, Houston; Secretary and Treasurer, C. L. WAKEFIELD, Dallas. Directory: The officers and W. H. WEISS, San Antonio and GEORGE B. HENDRICKS, Fort Worth.

Next meeting, Galveston, third Wednesday in March, 1896

PENNSYLVANIA STATE STREET RAILWAY ASSOCIATION.

Next meeting, first Wednesday in September, 1895.

President, JOHN A. RIGG, Reading; First Vice-President, ROBERT E. WRIGHT; Secretary, S. P. LIGHT, Lebanon; Treasurer, W. H. LANIUS, York.

THE MAINE STREET RAILWAY ASSOCIATION.

President, W. R. WOOD, Portland; Secretary and Treasurer, E. A. NEWMAN, Portland; Executive Committee, W. R. WOOD, Portland; GEORGE E. MACOMBER, Augusta; F. M. LAUGHTON, Bangor; FRANK W. DANA, Lewiston; AMOS F. GERALD, Fairfield.

MICHIGAN STATE STREET RAILWAY ASSOCIATION.

President, W. L. JENKS, Port Huron; Vice-President, W. WORTH BEAN, St. Joseph; Secretary and Treasurer, B. S. HANCHETT, JR., Grand Rapids; Executive Committee, the OFFICERS and DAVID H. JEROME, Saginaw, and STRATHERN HENDRIE, Detroit.

THE STREET RAILWAY ASSOCIATION OF THE STATE OF NEW JERSEY.

President, THOS. C. BARR, Newark Vice-President, W. S. SCULL, Camden; Secretary and Treasurer, CHARLES Y. BAMFORD, Trenton; Executive Committee, OFFICERS and C. B. THURSTON, Jersey City; H. ROMAINE, Paterson S. B. DOD, Hoboken.

539,454. Carbon Brush. Elihu Thomson, Swampscott, Mass., assignor, by mesne assignments, to the General Electric Company, Schenectady, N. Y. Filed Feb. 6, 1895.

539,500. Automatic Time Switch for Storage Batteries. William Biddle, Brooklyn, N. Y. Filed May 18, 1894.

539,501. Electrical Instrument for Medical Purposes. Benjamin Y. Boyd, Wichita, Kan. Filed Aug. 27, 1894.

539,508. Car Fender. Joseph J. Feely, Walpole, Mass. Filed Nov. 9, 1894.

539,512. Telegraph Relay. Alois Gruner, San Francisco, Cal. Filed July 28, 1894.

539,516. Trolley for Electric Railways. John W. Hoag, Newark, N. J. Filed Jan. 19, 1895.

539,529. Electric Railway Signal. Henry V. Miller, Bloomington, and Alexander C. Miller, Aurora, assignors to the Miller Incandescent Railway Signal Company, Chicago, Ill. Filed Jan. 5, 1895.

539,530. Sanding Device for Street-Cars. William A. Mitchell, Boston, Mass., assignor of one-half to Frank O. Furber, Saco, Me. Filed Jan. 16, 1895.

539,537. Cleaner for Incandescent-Lamp Bulbs. William O. Niles, Boston, Mass., assignor to Frank A. Chapman, New York, N. Y. Filed Apr. 13, 1894.

539,542. Magnetic Car-Balancing Device. William B. Purvis, Philadelphia, Pa., assignor of one-half to John Alexander Craig, same place. Filed May 26, 1894.

539,559. Electrical Low-Water Indicator for Boilers. Charles D. Tisdale, Boston, Mass., assignor, by direct and mesne assignments, of three-fourths to John D. Gould, Brooklyn, N. Y., and Charles A. Hanson, Orange, N. J. Filed Apr. 19, 1894.

539,564. Car-Fender. Joseph Zeis, Trenton, N. J. Filed Apr. 17, 1894.

539,576. Electric Safety System for Railway-Draw-Bridges. Edward Deming, Brooklyn, N. Y. Filed Apr. 4, 1894.

539,583. Electric Cut-Out. John R. Hersh, Denver, Col., assignor to Louis E. Kenworthy, same place. Filed Jan. 11, 1895.

539,585. Rheostat Face-Plate with Supplementary Rheostat. Frank Kramer and Max Kruger, Chicago, Ill. Filed Sept. 19, 1894.

539,616. Electrical Bond-Clamp. Alfred Green, Rochester, N. Y. Filed Aug. 27, 1894.

539,622. Cut-Out for Arc Lamps. Peter Kirkegaard, Brooklyn, N. Y. Filed Nov. 9, 1894.

539,676. Car-Fender. William C. Ellis, Memphis, Tenn. Filed Aug. 17, 1894.

539,681. Base for Trolley-Poles. Alfred Green, Rochester, N. Y. Filed Sept. 5, 1894.

539,695. Brake Apparatus for Railway or Street Cars. Carlo Margutti and Guglielmo Miani, Milan, Italy. Filed May 10, 1894. Patented in Italy Mar. 16, 1894, LXX, 186.

539,701. Multiple Signal-Transmitter. Bernice J. Noyes, Boston, Mass., assignor to George W. Gregory, same place. Filed Nov. 4, 1890.

539,712. Telephone-Call. Frederick J. Troll, Washington, D. C. Filed Sept. 22, 1894.

539,726. System of Controllers for Electric Motor-Cars. Charles L. Coombs, Washington, D. C., assignor to Theodore P. Dale, Marietta, Ohio. Filed Nov. 12, 1894.

539,735. Safety-Guard for Cars. Samuel A. Groff, Washington, D. C., assignor, by direct and mesne assignments, of nine-sixteenths to Patrick James A. Smith, and W. Kesley Schoepf, same place. Filed Nov. 3, 1894.

ELECTRICAL AGE

Vol. XV., No. 23. NEW YORK, JUNE 8, 1895. Whole No. 421

Established 1883.

Entered at New York P. O. as second-class matter, January 18, 1891.

THE ELECTRICAL AGE PUBLISHING CO., Publisher

TERMS OF SUBSCRIPTION:

One Copy, one year,	$3.00
One Copy, six months,	1.50
Great Britain and other Countries,	4.00

Cable Address (all Cables,) "Electage," New York.

W. T. HUNT, President F. N. BASSETT, Vice-President.

T. R. TALTAVALL, Secretary and Editor.

NEWTON HARRISON, E. E., Scientific Editor.

Canadian Representative, E. W. SAYER, Montreal, Que.

ADDRESS ALL COMMUNICATIONS TO

THE ELECTRICAL AGE PUBLISHING COMPANY,

First Floor, World Building.

NEW YORK.

NEW YORK, JUNE 8, 1895.

CONTENTS.

AS TO THE TELEPHONE SITUATION.

By the recent decision of the Court of Appeals in Boston, in the Berliner case, the sentiment of the people was outraged. The will of the people makes the laws, and what is right will in the end prevail. The true situation in regard to the Berliner patent is this: The government sought to annul the patent on the ground that fraud was used in procuring it. The government won its suit, which result virtually branded the word "fraud" all across the face of the entire Berliner business. This verdict was regarded as right and just by all fair-minded people in and out of the legal profession. The great telephone monopoly, smarting under the sting thus applied, used its most powerful influence to upset the verdict of the people, which it accomplished in Boston last month through the medium of the Court of Appeals. The case therefore stands where it did before the government suit was begun. The last decision, in effect, says that the lower court erred in rendering its decision in favor of the government. This decision might properly be construed also as saying that the Berliner patent was not obtained by fraud. But this doctrine will not go down. No ordinary mortal knows what the Bell Company will try to do next. There are pending no infringement suits based on the Berliner patent, and if any are attempted the many independent and worthy telephone companies can by co-operation in a fight prove a bigger adversary than the Bell Company dreams of. The Bell Company forms only a microscopical portion of the concrete activity in this broad land. Its will is not law by a good deal. The people will have their say, and the majority will overwhelm the minority. Meanwhile our enterprising fellow-citizens, who are applying their money, time and labor to the upbuilding of legitimate business, must not become alarmed. Their cause is a just one. "Might is Right."

MORE GENERAL ELECTRIC AND WESTINGHOUSE RUMORS.

It is again reported that negotiations have been renewed between the General Electric and Westinghouse Companies. It is the same story that was recently used with great effect upon the stock market, and there does not seem to be anything more tangible in the present rumor.

A Schenectady despatch says: "It is accepted as a fact that the General Electric Company has had an offer of 100 acres of land and $1,000,000 cash to consolidate all its factories at one place in New Jersey. The company engineers have reported that the saving of expenses by consolidating the factories at Lynn, Mass.; Harrison, N. J., and in this city at some point near Philadelphia or New York, would offset the loss which would result from selling their factories at the points named. The officers of the company refuse to be interviewed, but it is accepted as a fact that the company will desert this place."

In an interview regarding the matter, Director F. S. Hastings said that there was no truth whatever in the report that a large amount of money had been offered to the company to consolidate its factories at one point.

"In fact," he said, "no money whatever had been offered to the company for such a purpose, although it is true that real estate men and syndicates have offered land at different times. I don't think, however, that there is any occasion whatever to consolidate our interests any more than they are at the present time.

"You know that we have concentrated all of our incandescent lamp factories in Harrison, and all of our power appliances in Schenectady, while in Lynn we have our traction department. It would cost a great amount of money to transfer all of our interests to one locality, and I see no especial benefit in doing so at this time.

"As for renewing negotiations with the Westinghouse Company, as is reported, I know nothing about it, and I am very sure that if such a thing were going on I would be apprised of it."

THE NIAGARA FALLS PARK AND RIVER ELECTRIC RAILROAD.

The thunder of Niagara has been heard all over the globe, and it would be difficult indeed to find a civilized community in any part of the world that has not at least heard of the wonderful falls.

Niagara Falls probably stands at the head of the list of popular resorts. The stately majesty of the mighty fall as it leaps over the precipice is indeed awe-inspiring, and it is no wonder that Niagara has afforded endless themes for the painter and the poet. In addition to the enchanting attraction of the falls themselves, the trip from the cataract to Lake Ontario is an endless change of scenery of the loveliest character. Nature seems to have bestowed upon Niagara and vicinity a wealth of glory that cannot be equalled by any other locality in the world. The grand scenery makes the beholder stand aghast and wonder at the mighty power of Nature. In whatever direction we may turn, a vision of natural loveliness greets the eyes. The charm grows upon a person the oftener Niagara is visited, and it is not surprising that the poet and the painter never tire of its beauty.

A magnificent view of the famous Whirlpool rapids is obtained as the cars pass by, and an opportunity is given tourists to go down to the level of the rapids by means of the inclined railway.

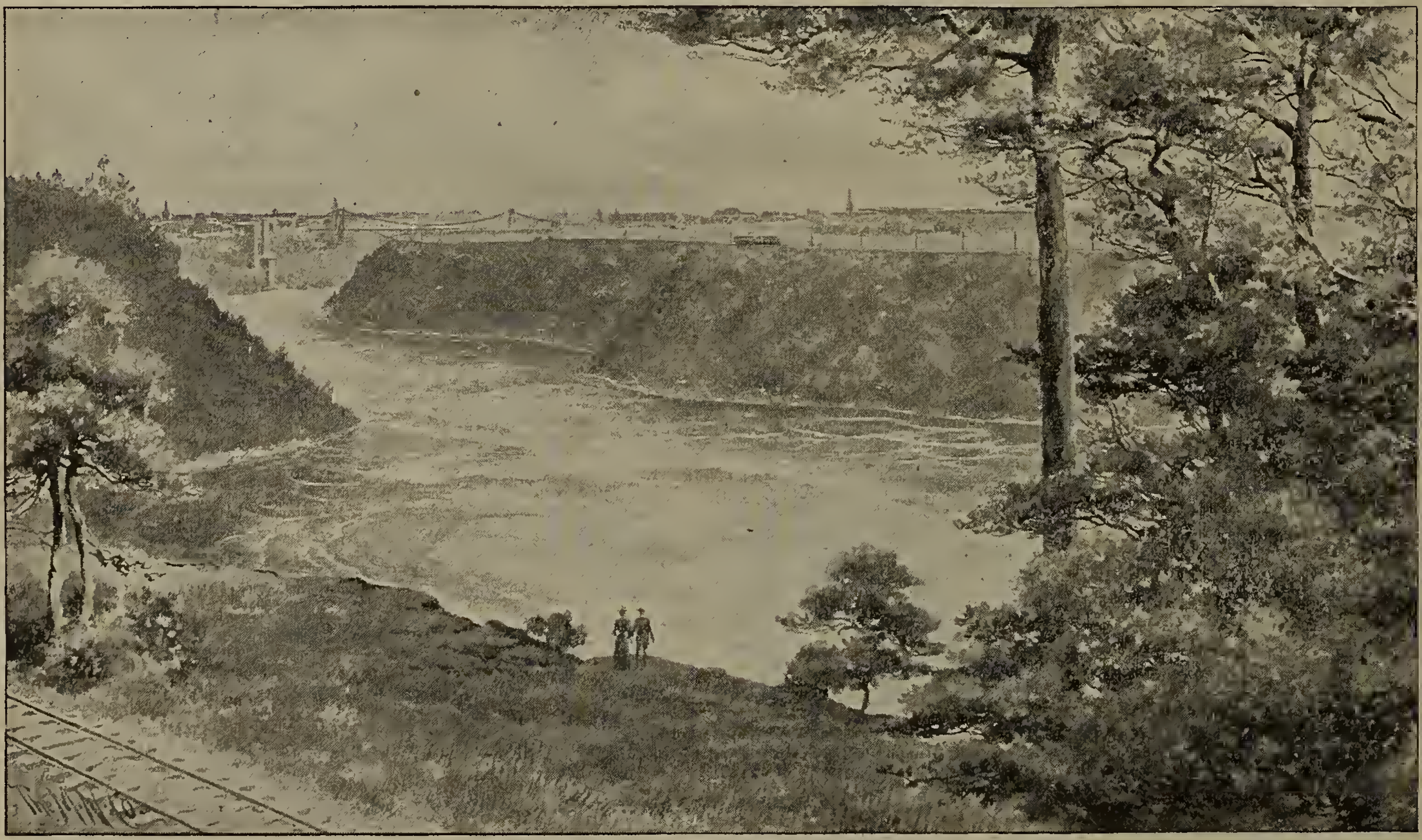
The next point of interest is the "Whirlpool." The water in this pool is constantly revolving like a huge eddy—as such it is—and according to legend, it never gives up its dead.

At the Whirlpool the road passes over a high trestle which spans a ravine. From this dizzy perch a magnificent view of the whirling waters is obtained.

After passing the Whirlpool the river becomes more serene, but the scenery continues to the end ever changing and entrancing.

So much for the romantic side of our narrative. We will now become more prosaic and, for the benefit of those of a more practical turn of mind, briefly describe the road itself and its appurtenances.

The Niagara Falls Park and River Railway was built entirely by Canadian capital and labor, and is operated by Canadians; even the equipment is practically Canadian. The road is a model of its kind, and in construction and equipment is not excelled by any American enterprise.



VIEW OF NIAGARA RIVER, FROM NIAGARA FALLS PARK AND RIVER ELECTRIC R. R.

The trip from the Falls to Lake Ontario is one of ever-changing beauty. The best way to see and visit all points of interest is to take the Niagara Falls Park and River Railway, an electric road running along the Canadian shore from Chippawa, Ont., to Queenston, Ont., which is opposite Lewiston, N. Y., and near the mouth of the Niagara River. This road, while altogether in Canadian territory, affords the best opportunity to see the glories of Niagara. It runs along the edge of the river practically the entire distance between the points named. The edge of the river in this case, however, does not mean low banks and tranquil waters. The river, below the falls to Lake Ontario, flows through a chasm, which gradually decreases in abruptness as Lake Ontario is approached.

As we ride along the Niagara Falls Park and River Railway the best obtainable views are afforded of the Rapids and the great Falls themselves. The road then runs close to the edge of the precipice, passing through Queen Victoria Park, under the great suspension and cantilever bridges, through the town of Niagara Falls, Ont., thence to Queenston, passing, on the way, Brock's monument, which stands on high ground, and which is erected on the spot where General Brock, of the English forces, fell in battle during the conflict for American independence from British rule.

There is no curve on the road of less than 37 per cent., and the grades are of very little consequence. The rails are of the C. P. R. standard, 56 pounds to the yard, and of steel, the ties of tamarack and cedar, being laid from 2 feet to 2 feet 6 inches apart. The gauge is the standard—4 feet 8½ inches,—and the road is well ballasted.

This construction gives a very substantial road-bed, over which the cars run with remarkable smoothness. The entire length of the road is 60,040 feet—or about 11½ miles. Tubular steel and cedar poles are used in the overhead construction work, the maximum distance between poles being 100 feet. On some curves, where the feeders are heavy, the poles are 40 to 50 feet apart.

All the steel poles are set in concrete, while the wooden poles are provided with a concrete footing and 12 inches of concrete around the base.

No. 00 B. W. G. hard-drawn copper trolley wire is used throughout the entire length of the road. This is supported on iron brackets. The rails are bonded with No. 0 B. W. G. wire, and half-inch copper rivets, and cross-bonded every fourth rail. Ground connections are secured by attaching No. 00 copper wire to a piece of standard rail, the latter being placed in the water of the river. The entire electrical equipment of this road is the work of the Canadian General Electric Co., of Toronto, the Ontario Construction

Co. doing the overhead construction work under sub-contract.

The rolling stock consists of 18-foot ordinary box cars with two W. P. 50 motors; open 28-foot cars, equipped with like motors and observation cars, 35 feet in length, also having the same type of motors. Trailers also form part of the equipment.

The car bodies were manufactured by Paterson & Corbin, of St. Catharines, Ont., and are very solid, which is the main characteristic of all English or Canadian construction work.

Along the road regular stopping-places are provided, at each of which raised platforms facilitate embarking and discharging passengers. The cars, however, stop anywhere on signal, so that it is not always necessary to make an involuntary trip to find a platform.

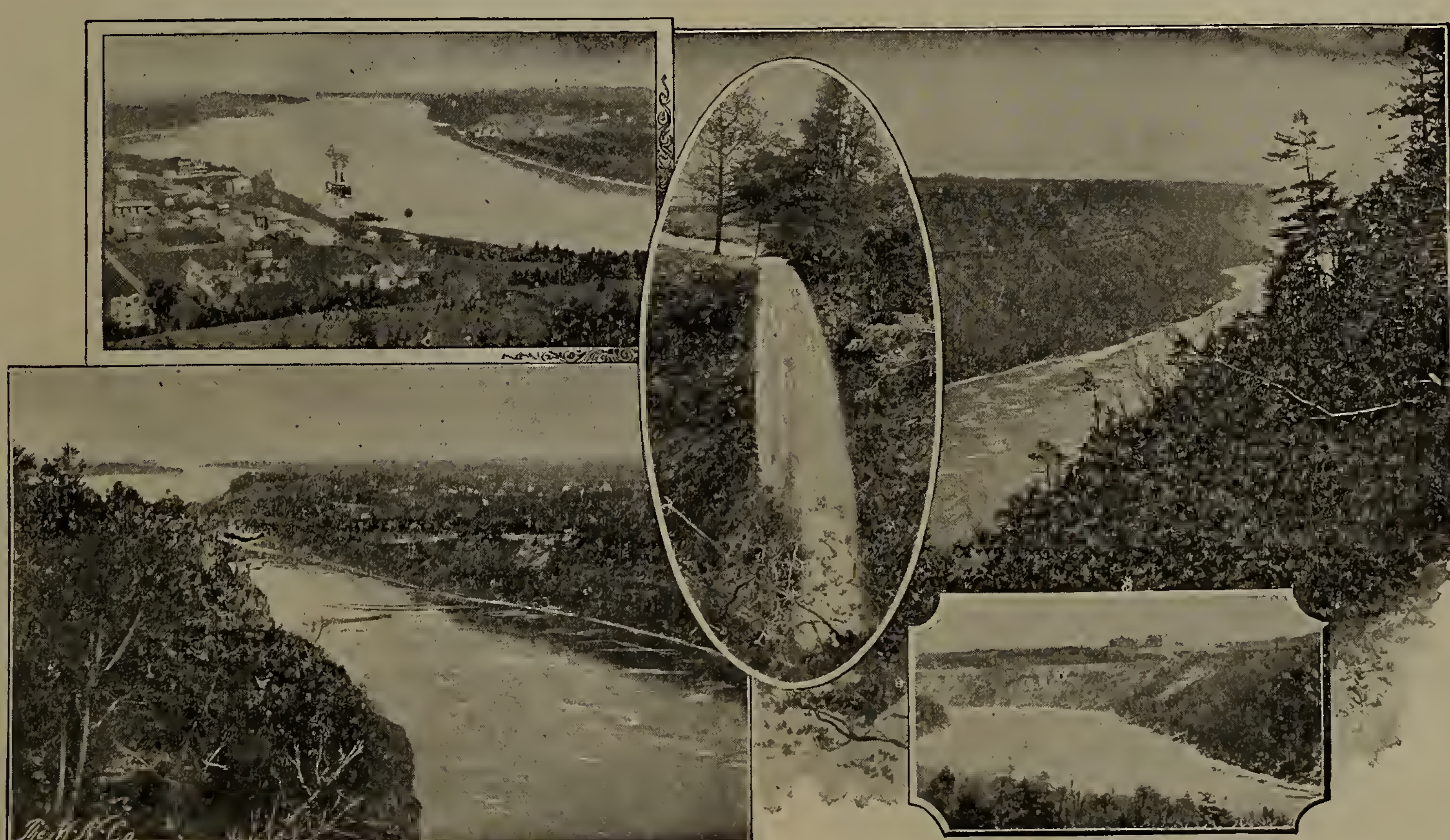
There are two power houses; a large stone structure, designed by Mr. J. A. Balfour, of Hamilton, stands just above the Falls. The second one is of less architectural pretensions and is situated a short distance from the wharf at Queenston.

The head of water utilized in the main power house is 57 feet. The wheel pit is 85 feet deep, the tail water at six tons. The water-wheels are set on a line parallel with the sides of the power house.

The switchboard is divided in seven sections and is of polished slate set in an iron frame. Switches also provide that parts of the line may be kept at a higher pressure than others by connecting the corresponding feeders with a generator or generators isolated from the rest. The potential at this station is kept at from 550 to 600 and the average current runs from 300 to 400 amperes.

The motive power at the lower station is steam, the boilers and engines coming from the Goldie & McCullough Co., of Galt. There are two tubular boilers of seven-sixteenth-inch steel, rated at 150 horse-power each, two Wheelock condensing engines 17×38, with large driving wheel and with a clutch coupling so that they may be run in conjunction. At present these drive an Edison and a T. H. generator of 100 k. w. each. The two are not used continually, one being sufficient for the average load. The other is thrown in on special occasion.

The switchboard is in two sections and the current passes from the positive brush, through three-way switch, T. H. meters, buss-bar, feeders, ground, buss, circuit breakers, three-way switch and back to the generator.



VIEWS ALONG NIAGARA FALLS PARK AND RIVER ELECTRIC RAILROAD.

the bottom standing at about 12 feet. The tail-race tunnel is 600 feet long and discharges beneath the Falls. The water is carried in a head-race from the foot of the upper rapids into a cut-stone forebay which is fitted with iron headgates 7½ feet in diameter. From this forebay the water is conducted through two intake pipes to two vertical penstocks 44 feet deep and 7½ feet in diameter, made from ⅜-steel plate. These penstocks are enlarged to 10.6 diameter for five feet up from the bottom to receive the water-wheels, and have steel draft tubes nine feet long attached to the bottom plates for the water-wheels. The water-wheels are the well-known "New American" turbines and are particularly adapted for electrical work. There are two 45 inches in diameter, with accommodation in the wheel pit for a third, and each capable of developing 1,000 horse-power under the head of water mentioned above. They make 221 revolutions per minute when at work. The upright shafts are forged steel six inches in diameter; they are supported by four iron bridge trees in each penstock, and are fitted with lignum vitæ boxes and thrust bearings. The driving gears on the tops of the upright shafts are mortise wheels 75 inch diameter, 18 face and 5½ pitch. These gears are banded with heavy wrought-iron bands. Each pair of wheels weighs over

The road is double tracked throughout. A length of track from Chippawa to Slater's Point, a distance of 1¾ miles has been built. At Slater's Point landing connection is made with steamers to Buffalo and other points.

The popularity of the road is increasing every day, and thousands of passengers are carried over the line each week. By no other method can so much be seen for so small a cost, the price for the round trip being only 75 cents.

Mr. Ross Mackenzie, a well-known railroad man in Canada, is the general manager of this line.

Every visitor to Niagara Falls should make the trip over this line, as no other means of sight-seeing at Niagara affords such easy opportunity to see the wonders of this famous resort.

A REPRESENTATIVE TRADE JOURNAL.

THE ELECTRICAL AGE, years ago started out to advocate the cause of the telegraph and the telegraphers, but as time flew so did the AGE, not to abandon the old field, but to add new territory, so today it has become a representative trade journal of all branches of electricity. We congratulate our friends and bespeak for them a still wider field of usefulness.—Kansas City *Architect and Builder.*

WHAT CONSTITUTES A TUBE?*

The rules of the New York Board have heretofore required that all interior conductors be "separated from contact with walls, floors, timbers, or partitions through which they may pass, by non-combustible insulating tube." In placing its approval upon Attix wire for use on a par with the metallic conduit system, the electrical committee of the New York Board made a very poor attempt to give its action a semblance of being in accord with the standing requirements of the rules of the Board. In the resolution the superintendent is authorized to "approve the use of the Attix tube and wire." This wording—calling Attix wire a "tube and wire"—has called forth a storm of ridicule from the electrical journals. One need be little of an electrician to form his own opinion as to whether Attix wire is a tube, or the equivalent of a tube. We present herewith illustrations of Attix wire (showing the heavy extra insulation, and also how it may be penetrated by a nail) and the metallic conduit or tube.

The absurdity of calling these two equivalents for building installations, or of calling Attix wire a tube, must strike any reader, however ignorant of electricity. It is perfectly apparent that Attix wire is simply a copper conductor with an extra, double, braided insulation, and that it has nothing in the nature of a tube. It is also easy to see that it is liable to be penetrated by nails where drawn beneath floors or between wall without protection (as it is in many installations made by permission of the committee on electricity of the New York Board). On the other hand, in the metallic conduit system the tube forms a complete protection for the wire and its insulation, and renders it possible to examine or remove the wire without trouble. The tube is no part of the insulation of the wire. The Attix wire affords no means of replacing a damaged conductor. Once imbedded in masonry or cement, the copper wire could never be removed without destroying all of the insulation, including the outer covering which the

ATTIX WIRE.

committee has declared to be a tube. Imbedded in plaster Attix wire would be as dangerous as when drawn beneath floors without protection. There are some kinds of cement or plaster the chemical action of which no covering short of a metallic tube can long resist. Attix wire is certainly a high-grade wire and a valuable one for many purposes; but it does not seem rational to seriously discuss the question whether it is as good as the interior conduit system for building installations.

Before the adoption of the resolution that has caused all the trouble the committee on electricity of the New York Board held a meeting, at which a number of experts were present, to discuss the relative merits of Attix wire and the interior conduit system. At this meeting, Prof. Morton, of Stevens' Institute, contended that Attix wire was a tube, and stated that he considered it quite equal to the conduit system. Prof. Morton enjoys a wide reputation as an expert (rather in laboratory work than practical engineering, though, his opinions not being accepted as final authority by electrical engineers), and the views expressed by him at this meeting led some of the electrical papers so far as to impute to him improper motives. Such world-famed practical experts as Prof. W. A. Anthony and Mr. Edward H. Johnson ridicule the stretch of language by which Attix wire is called a tube, and contend that the resolution in question is a long step backward in the effort to attain and

INTERIOR CONDUIT.

establish a superior and safe system of interior installation.

Mr. F. C. Moore has come forward to defend Prof. Morton from the imputations made, confessing that he himself is "largely responsible" for the action of the electrical committee. His warmth and activity in behalf of the Attix wire resolution are sufficient evidence of that fact without the specific confession. He gives no reason why Prof. Morton should call a wire a tube, nor does he state his own motives in the matter; as to the latter no one expects enlightenment, for the ways of Moore are, to ordinary mortals, inscrutable.

In our opinion the electrical committee of the New York Board did very unwisely in departing from the requirements of the rules as to interior conduits, and committed, moreover, a breach of the proprieties in naming one particular wire of a certain grade for its approval, instead of making the terms of its resolution general, so as to include any wire and all wires of equal grade.

* From the *Insurance Advocate*.

DINNER OF THE FRANKLIN ELECTRICAL SOCIETY.

The Franklin Electrical Society, of New York, celebrated its fifth anniversary by holding a dinner at Rickadonna's restaurant, Union square, on the night of June 1. Besides many members of the club, several invited guests were present.

An elegant dinner was served, and between the courses papers were read and discussed and impromptu remarks made.

Mr. Newton Harrison acted as master of ceremonies, which position he filled with excellent tact. President Ker sat at the head of the long table. He opened the exercises by giving a short history of the club and predicted for it a successful future.

Mr. Ernest V. Lallier read a short paper on the Storage Battery which was very fully discussed.

A very excellent paper on Conduit Systems of Street Railways was read by Mr. M. J. Levy, and it, too, was earnestly discussed, many valuable points being developed.

Mr. Edgar S. Barney, of the Hebrew Technical Institute of New York, made a few remarks of a character complimentary to the society and its purpose. The society, he said, contained the germs of great usefulness and achievements, and he thought that the idea of naming it after Franklin, was an excellent one. Franklin was one of the greatest men in the history of our country, and his was an honorable name.

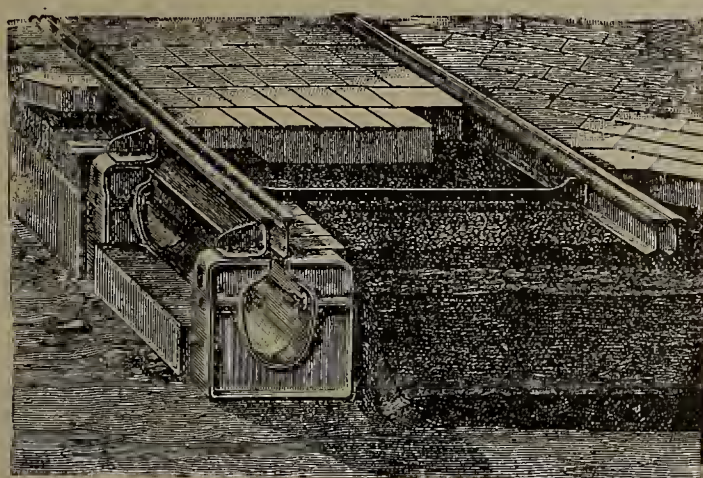
Remarks were made by others present, and it was well along towards Sunday morning when the meeting adjourned. It was a decided success in every respect.

CONDUIT RAILWAYS.*

BY MAX J. LEVY.

Since electric traction became commercially assured, the minds of inventors have been turned toward some method of propelling street cars electrically which would not employ the overhead trolley.

This is natural, for while the trolley system is a good method of traction, it is undesirable in large, thickly populated cities, for it cannot be expected that after a city has spent millions of dollars to place all overhead wires in underground conduits, it will again permit poles to be erected, and to have wires strung which convey electricity



BUDA-PESTH UNDERGROUND CONDUIT ROAD.

at a high tension. Even putting aside the danger of falling wires, the unsightliness of such a system is enough to condem it in the minds of municipal governing bodies which consider local pride.

Conduit railways can be classed under three heads:

1. Those employing a wire in an underground conduit which is connected with a feeding conductor on the surface of the ground.

2. Closed conduits, or those having conduits which open as the car passes along and close after the car has passed.

3. Open conduits, which are built upon the plan of the cable roads, having the working conductors placed in a duct conveniently near or between the tracks, an open slot allowing connection to be made to the car motor.

Roads having the supply feeder on a level with the surface of the earth can be divided into the continuous circuit and the block systems.

The manner of transmitting the current on continuous circuit roads of this sort is either by using one track as the positive conductor and the other as the negative, or by a central rail as the feed and the tracks as the return.

It is obvious that such a system cannot be successful for urban surface transit. In the first place it offers a serious menace to horses, and then the danger of short circuits would make it a failure from an electrical point of view.

Mr. Edison at one time gave out information that he had invented a road of this kind which would obviate all the difficulties mentioned. He proposed transmitting a 1,000 volt current to motor dynamos placed at convenient intervals along the road, which would reduce the potential to 20 volts to be delivered directly to the tracks. He claimed that the voltage would be so low that no leakage, ground or short-circuit of a harmful nature could occur; nor would horses be affected. For such a low voltage it was necessary to design a collector which would not become insulated because of dry dust, etc. A rather ingenious arrangement was gotten out to overcome this difficulty. Points projected radially through the car wheels. These points were movable and were projected out by springs. As the wheels turned the points would dig through any dust in their path. Whether these points would have the desired carrying capacity is doubtful.

The block system of operating these roads is a decided step in advance of the crude methods just explained.

* Read at meeting of the Franklin Electrical Society, New York, June 1, 1895.

The centre or conducting rail is divided into sections of about a dozen feet, each insulated from the other. The object of such a construction is to have only that portion of the conductor alive over which the car happens to be. This is necessary to lessen danger of short circuits, in order to prevent accidents to horses or even to pedestrians, for a wet day makes shoe leather a very good conductor.

Several methods are employed to switch each section in as the car reaches it and to throw it out of circuit as the car leaves it. In one proposed system electro-magnets are attached to the bottom of the car, which, upon coming over the contact boxes, attract iron armatures, which in turn throw contact points into circuit. These points being in contact with the collector on the bottom of the car transmit the current to the motor.

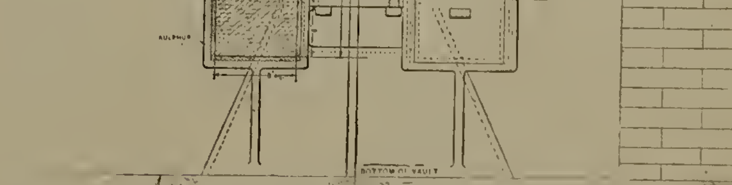
Another system depends on the contact made by a small piece of iron, which is attracted by a magnet as the car reaches the insulated point between two sections of the conducting strip.

A modification of this is a system in which the contacts are iron filings, which bridge over from the main to the contact rail.

The latest to enter the field of such railroads is the Johnson-Lundell system. This employs an electro-magnetic device for switching. In addition to the block system this road is reinforced by a separate secondary battery system, so as to make the cars independent of the conductors should an accident disable that portion of the road.

The fact that storage batteries are employed is fairly certain proof that the system is faulty. While cheapness is one of the good features of a surface block system, unreliability is its very serious drawback.

I cannot understand how a company can advocate a system that necessitates the operation of two separate methods. Even allowing the claims of the inventors that, including a separate storage system, it is not very expensive, it certainly costs money to carry half a ton of storage batteries. The batteries are supposed to charge while the cars are in motion. How long the charge will last depends on how soon after the car has left the station an accident to the line occurs.



CROSS SECTION, LENOX AVENUE LINE, NEW YORK CITY.

There is but little to be said regarding closed conduit roads.

The Van Depoele system has a small conduit placed between the rails in which is a bare conductor. The conduit has two rubber lips which close together. The car has a plow attached to the bottom of it which, as it travels, pushes the lips open; the lips closing after the car has passed.

The objection to such system is that the opening around the plow is necessarily large enough to permit water to enter the conduit; then the wear on the lips is considerable.

An inventor of a similar system proposed the use of air under high pressure to prevent water from entering the conduit. The horse-power required to accomplish this, when there are many cars on the line at once, would be an item of considerable expense.

In speaking of open conduits I am glad that I can point to a railroad of this kind that has proven commercially successful. I refer to the Siemens-Halske road now in operation in Buda-Pesth, Austria. Were it not for this road my paper would simply be an account of failures and costly experiments.

In this system, as now in operation, the conduit is placed directly under one of the rails, concrete forming the greatest element in its construction. Castings are placed about four feet apart, and support the tracks and insulators. Angle bars of copper are attached to the insulators and form the conducting system. The conduit is 13 inches deep and the total depth from the top of the slot is 27½ inches. The conduit being 11 inches wide, is of sufficient capacity to allow for considerable surface drainage. The voltage employed on this is 300. The mains are lead-covered cables laid in the earth along the line and are connected with feeders which connect to the working conductors. Regarding the efficiency of this system, I will quote from the report of the Metropolitan Traction Company, of this city.

"From January 1, 1892, to June 30, 1892, the conduit lines in Buda-Pesth carried 5,485,010 passengers. The cars travelled 630,648 miles. The total cost of operation was $58,039.63; the receipts, $141,980.77, which shows that the road was operated for 40.8 per cent of its receipts. The average receipts per passenger were 2.6 cents and the expenses 1 06 cents. While the rate of wages is about one-half that of this country, the price of coal is about three times as great and the rate of fare one-half. Hence it may be inferred that the operating expenses in the two countries will be about the same."

The operating expenses per passenger per car mile is about 14 cents, which does not show well in comparison with cable roads, which is about 10 cents per car mile. However, cable roads are limited to about five miles for efficient operation; hence the comparison between the two can hardly have much weight, as the electric line is about twelve miles long.

The Metropolitan Traction Company is now experimenting with a system similar to the one just described. It is the design of the General Electric Company. Instead of having the conductors in the conduit proper, they are riveted to the slot rails. In both this and the Siemens-Halske road sliding contact is used. What the outcome of the experiments the Metropolitan Traction Company is carrying on will be is hard to imagine, as the climatic conditions prevalent in this city are different from those in Buda-Pesth.

Among the failures that can be mentioned in open conduit railways is that of the Bentley-Knight system.

In the construction of this road in Boston, a system similar to that employed by Siemens & Halske was used. The road was five miles long, and although in operation for nearly a year, it was abandoned, due to continual electrical troubles. In Fulton street, in this city, a road of the same kind was constructed, but a car, electrically propelled, was never run on it.

A system possessing a great many merits has been proposed by a Mr. Lawrence, of Wilmington, Del.

He uses a block system in connection with his conduits. Immediately under the slot rail he places his conductor, which is in sections insulated from each other. As the car passes along the heavy sub-surface trolley wheel forces the rail down. This in turn acts on a lever, which closes the switch in a junction box placed near the tracks.

The exposed position of the conducting rail is a poor feature of the road, as both it and the insulators are likely to become covered with surface drainage and moisture, and thus spoil the switching apparatus, even if this apparatus were always in working order, which is doubtful.

It has been claimed that this road worked well, even though part of the conduit was filled with water.

It has been remarked that a good conduit road is simply a question of money. To this I will add that a good road of any description is one that puts money into the pockets of the stockholders.

JEFFREY ELECTRIC COAL DRILL.

The electric power coal drill, of which an illustration is given on this page, is a very serviceable machine, and is both efficient and light.

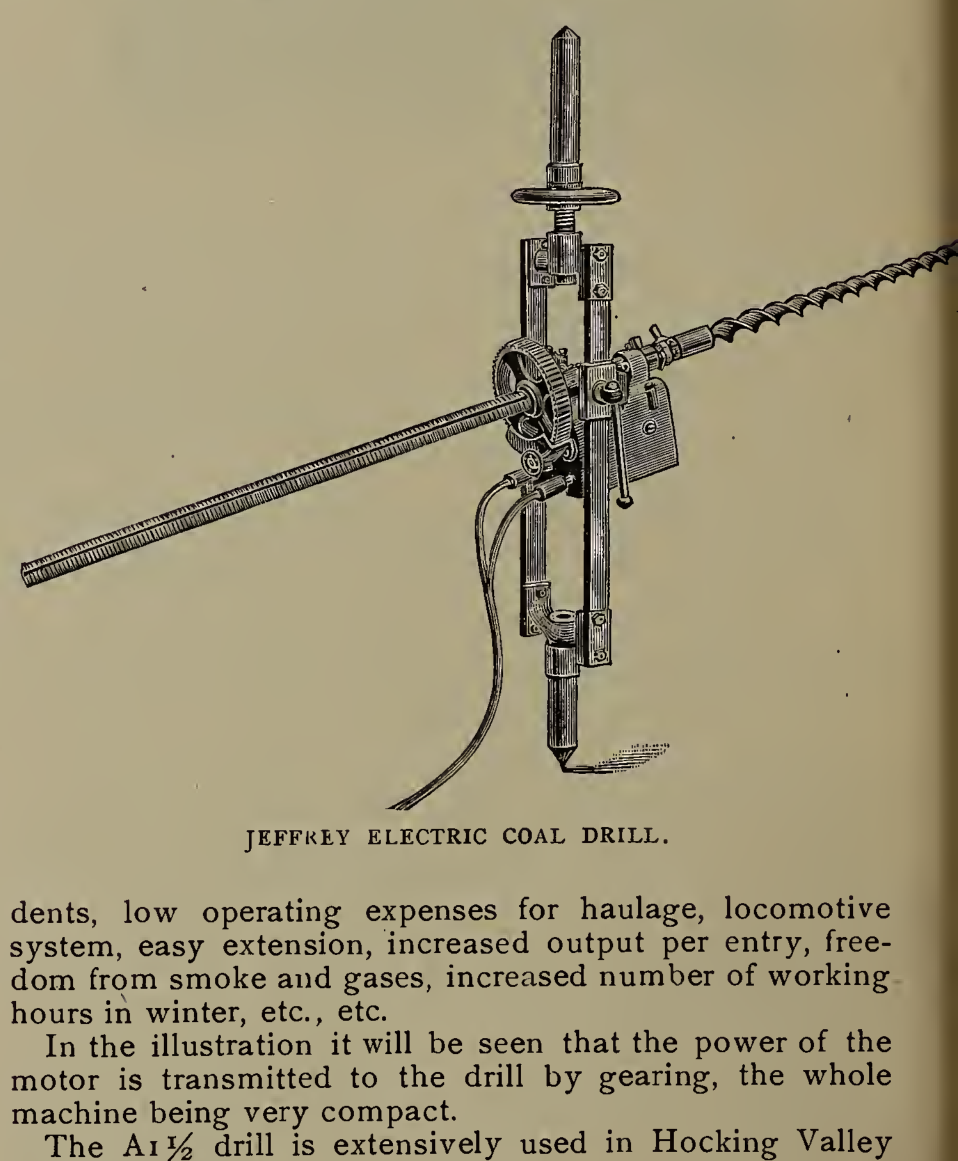
The particular design of drill shown in the illustration is classed by the manufacturers—the Jeffrey Manufacturing Co., of Columbus, Ohio,—as A1½. It has a 3-horse-power auger drill, and the machine complete with post for a 6-foot vein of coal weighs only 152 pounds. The drill works quickly, and has drilled holes enough in 10 hours to shoot down 800 tons of coal in a 7-foot seam.

One of these machines in a West Virginia mine, where the coal is soft, has drilled enough holes for 1,000 tons per day, and these figures represent every-day work.

While 3-horse-power is the nor..al rating of this drill, the machine will stand a 100 per cent. overload for short periods, thus enabling the drill to pierce slate and rock when encountered in work.

The drill is built for any height of coal.

The Jeffrey Manufacturing Company produces power mining machinery of the most approved types. Some of the advantages claimed for these machines are—reduction in cost of mining, safety for the miners and fewer acci-



JEFFREY ELECTRIC COAL DRILL.

dents, low operating expenses for haulage, locomotive system, easy extension, increased output per entry, freedom from smoke and gases, increased number of working hours in winter, etc., etc.

In the illustration it will be seen that the power of the motor is transmitted to the drill by gearing, the whole machine being very compact.

The A1½ drill is extensively used in Hocking Valley mines in Ohio.

NIAGARA FALL POWER PLANT.

The second of the 5,000-H. P. dynamos for the Niagara Falls Power Company has been delivered at the plant. It is now being installed and will be ready for preliminary test in a few days.

PERSONAL.

W. A. H. Bogardus, secretary of the Brooklyn Heights Railroad Company, has tendered his resignation to take effect on July 15 next.

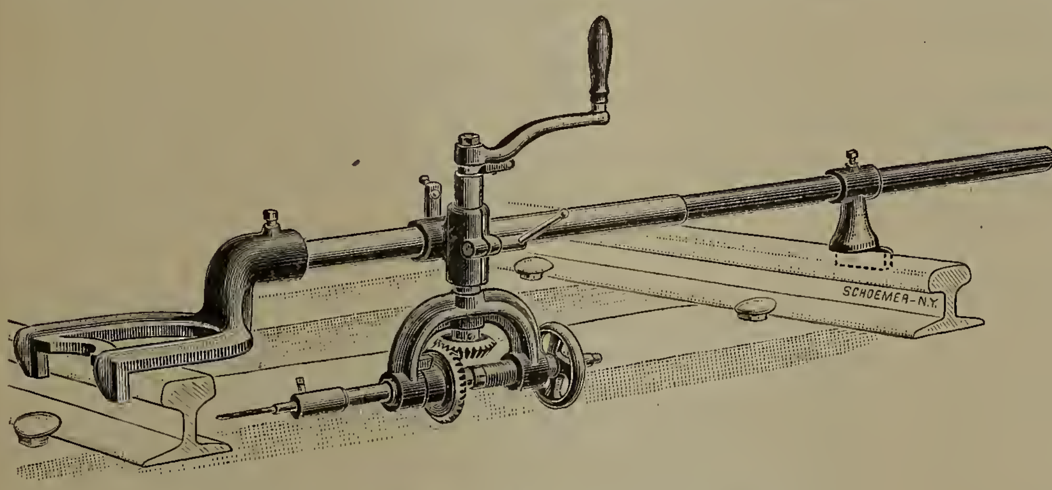
TRACK DRILL.

Our illustration shows a very convenient track drill for drilling holes in rails for electric bonding wires, and for binding rods, etc.

The Miller's Falls Company, of 93 Reade street, New York, has sold large numbers of their angular drilling machines, but they find that the horizontal shaft is more suitable and preferable for the work.

The shaft is clamped to the two rails as shown, giving a firm support for the drill, which is operated by means of the handle and bevel gearing.

Two sets of gears go with each drill, making it either speeded or geared back. The machine is comparatively light, weighing only 68 pounds, and will carry drills up to one inch in diameter. A chuck is furnished with each



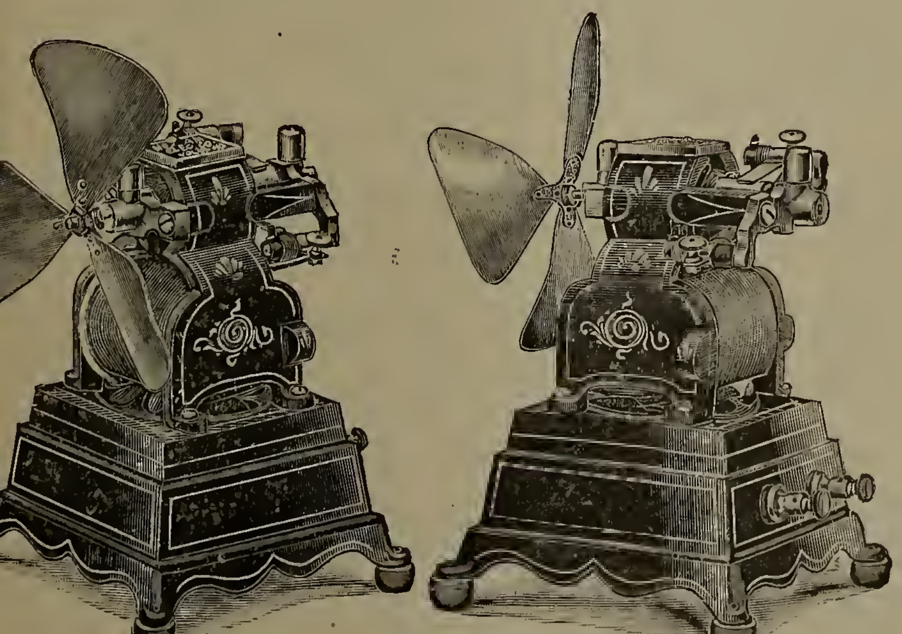
TRACK DRILL WITH HORIZONTAL SHAFT.

machine, which will permit of the use of drills smaller than one-quarter of an inch.

This drill performs its work quickly and accurately, and is meeting with much favor among street railway engineers.

THE NORTH AMERICAN COMPANY'S MOTOR.

The accompanying illustrations give two different views of a small direct-current fan motor made by the North American Electric Co., 181 William street, New York,



THE NORTH AMERICAN ELECTRIC CO.'S MOTOR.

which is said to be the smallest motor made to run on direct current without lamp resistance.

This motor is made in five sizes, carrying fans from 5 to 14 inches in diameter. The armature is of the three-coil type. The machine is simply wound, and constructed of the best material, under the personal supervision of the inventor himself.

The motor stands upon a finely finished iron base, inside of which is set a special rheostat.

The machines run at high speed and are practically noiseless in their operation. They distribute the air where it is most wanted.

This machine will no doubt find a large field of usefulness.

TELEPHONING TO THE MOON.

BY NEWTON HARRISON.

Are we alone in the universe? Are the countless planets desolate and void of life—is there no breathing thing—no living form—nothing but the everlasting silence to greet us? Have the planets ever been inhabited by sentient beings and are they now nothing but colossal tombs? Strange questions these; but how much stranger the pictured reality! Children of the earth—those that lived in prehistoric times—have left the same voiceless past behind them—the eloquent silence of a dead race.

Can we whisper across space to those that might have survived the untold ages—to worlds so much older than our own and so much greater that we feel aside of them, pitiful insignificance?

The solitude of desolation speaks to us from the moon. Its barrenness, and awful vistas of bare and lonely tracts lead to no hopeful expectations.

If charnel house it be—if all channels of thought lead but to one sorrowful conclusion—let us still attempt to call across—to search for reason in the emptiness of space. Perhaps in some remote corner the candle of life still flickers and conscious beings will answer to our cry. The ocean of ether quivers to every touch. It binds the planets together with an iron hand, flexible yet firm, solid yet infinitely elastic. Could any better choice be made than this ideal medium? When it moves, even to an extent inconceivably small, our sight is affected: we see. It takes eight minutes for these waves to reach us from the sun. Yet they bound from it at a prodigious speed, the enormous velocity of 192,000 miles a second.

It is possible to produce waves moving at this terrific rate by electrical means. A pulsation of electricity means an ether wave, and in the telephone we meet with infinitely small waves, producing speech. These waves spread out into space, radiating further and further in gigantic circles until swallowed up in its immensity like ripples on the bosom of the ocean.

If an iron mass be in the vicinity of these changes, it will give out a buzz or hum. Some systems of street lighting employ apparatus made partly of iron for the transformation of the high pressure down to a lower one. In these boxes may be distinctly heard the hum of iron, due to the influence of the sudden electrical changes upon it.

It is therefore possible by following out this principle to send electrical pulsations far out into the ether and have them act upon any metallic mass like iron with sufficient force to produce sound. If the moon be really a planet of the same general composition as the rest, it will undoubtedly contain its proportionate amount of iron.

This is very likely, because its only change has been a purely physical one, the probable loss of its central heat.

To build apparatus to carry on an experiment of so interesting a nature would necessitate the use of a gigantic coil mounted vertically with its axis in line with the moon.

By the use of currents that continually reverse it is pospossible to project waves into the planetary regions to an inconceivable distance. These wonderful vibrations will strike the moon, embrace it in every part and give rise with every timed change to a gentle hum.

If lives exist upon the lunar suface, if the murmur from the earth be heard, they will listen with sadness; they will feel that utter despair that brooks no consolation and stretches out its arms in vain.

—One cubic foot of water at 70° F. weighs 62.3 lbs.; 1 cubic foot of coal weighs from 80 to 100 lbs.

PRINCIPLES OF DYNAMO DESIGN.

BY

Newton Harrison, E.E.

(*Continued from Page* 310.)

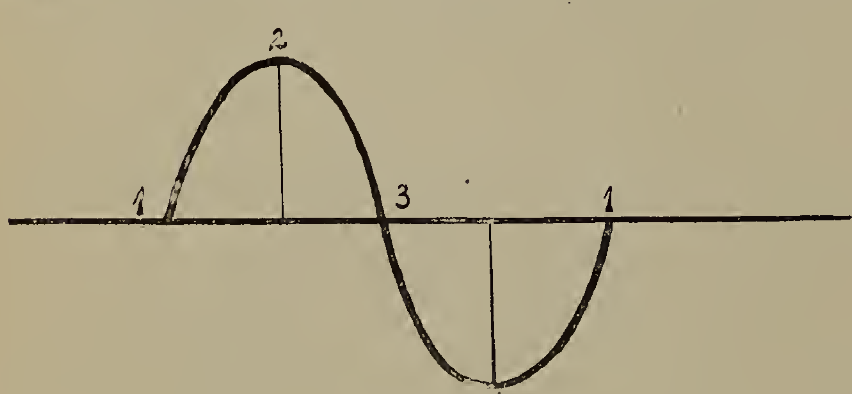
To return to the original discussion, the consideration of a turn revolving in a magnetic field and generating E. M. F., the rise and fall of pressure in such a case would occur according to a certain law, called the sine law, and the pressure would vary so that it would be diagrammatically represented by a sine wave.

As the illustration shows, there is a rise and fall of potential which corresponds to different positions of the armature with respect to the field. In the last sketch of a simple dynamo with the coil in a vertical position we are at the beginning of a cycle of changes indicated by the sine wave. The movement of the coil to the right will bring it to the position indicated in the sketch; if the first position be denoted by 1, then a quarter revolution, that is to say, 90°, will give us position 2, etc. Therefore the E.M.F. according to the sine curve is as follows:

Position.	*E.M.F.*	*Degrees of Revolution.*
1	0	0
2	maximum	90°
3	0	180°
4	maximum	270° and reverse flow
1	0	360°

The under curve shows that a reversal takes place as the coil begins cutting lines of force from the other pole. A complete rise and fall of E.M.F. with a growth and decrease in the same ratio, but an opposite direction, is called a period.

By the use of a commutator, the current at the instant before reversal flows into a brush placed in the proper position and is used as desired; so that the old name collector or rectifier might be applied in an explanatory sense.



SINE CURVE.

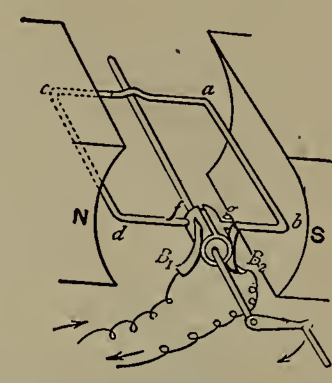
It is a simple matter to convert any continuous current machine except the disk dynamo into an alternating, if instead of a commutator simply two rings are employed which will transmit every change in pressure and current immediately to the outside circuit. If instead of using but one loop on one side of the shaft, a complete turn be employed, extending across from pole-piece to pole-piece, the current produced in one side of the turn will be opposite in direction to that produced in the other side; in other words, by revolving the loop we bring into action one turn but *two inductors*.

Therefore double the E.M.F. is generated each revolution, and in such a direction that they act in series with each other. By employing a commutator, which simply consists of a split shell so placed that, when the coil is in a vertical position between the pole-pieces, that half of the shell which had previously been under one brush now passes under the other, one reversal always takes place under one brush and the opposite change under the other, the result of which is a continuous positive flow to one brush, and a similar negative flow to the other, thus forming, when the two are connected, a complete electric circuit.

It is very important that the difference between these two conditions be clearly understood.

There are two general classes of armatures, namely, the ring and drum type.

In the ring we meet with a case in which the number of inductors are exactly equal to the number of turns. It has



IDEAL DYNAMO.

been proven by the experiments of Carl Hering that the inner side of the turn does not produce any E.M.F.; such being the case, the outer side of the turn is the only part actively at work during the revolution of the armature. It is in this sense an inductor, not a turn, yet it requires a turn in order that an inductor may be produced.

The general action of any inductor in a field with circular faces is simply to move up and down, although this motion in itself is curvilinear. The drum and Gramme armatures in their action differ in no respect from that described. The generation of E.M.F. in the drum occurs in the same manner with this difference—that the reverse electromotive forces do not cause a flow of current in separate coils but in the respective sides of the same coil, only reversing in direction each half of a revolution. If a ring armature were to be considered as reduced in diameter so that the separate turns on each side joined and became single turns, the drum armature is reproduced without any stretch of the imagination.

In considering the E.M.F. quantitatively, it is necessary to remember that whereas 500 *turns* on a drum would produce a certain E.M.F. it would take twice as many, or 1,000 turns on a ring core, to produce the same potential difference, other things being equal.

(*To be Continued.*)

THE HOT WEATHER FIEND IS AROUND AGAIN.

Look out for the wretch who asks you if it is hot enough. Whether it is hot enough for you or not, you will be justified in making it hot enough for him.

Mr. Dollard Indicted.—Mr. A. H. Dollard, president of the Lewis & Fowler Girder Rail Company and the Lewis & Fowler Manufacturing Company, has been indicted by the Grand Jury of Kings county, charged with having signed a declaration of a dividend when there was no surplus money to pay it, and when both companies were practically bankrupt. The inquiry by the Grand Jury showed that two months after the dividend was declared a receiver was appointed for the companies. It is alleged that nearly $170,000 had disappeared, and that an unexpected indebtedness of $80,000 was piled up against the companies.

Aluminum Caskets.—Burial caskets of aluminum are made by a Pittsburgh firm. The cost of an aluminum casket is about the same as ordinary metal ones, and they are said to be practically indestructible. There is a big and growing demand for the new goods.

WILL IT BE ENFORCED?

The June number of the *Insurance Advocate* propounds this question in relation to the Attix wire resolution of the New York Board of Fire Underwriters.

The *Advocate* says: Some of those to whom the action of the New York Board in approving the use of Attix wire in all cases where the standard rules require the interior conduit system appears highly absurd, and at the same time inimical to the interests of both property owners and fire underwriters, have indulged in a good deal of speculation as to the Board's motive in the matter. One theory advanced by the advocates of a high standard of interior installation is that the Board has allowed, by special permission, wiring in certain cases in violation of the rules, where it would be liable for damages if certificates were withheld and the work condemned; and that to protect itself from such liability the Board found it necessary to pass its Attix wire resolution and issue its certificates. The Cambridge Hotel, at Thirty-third street and Fifth avenue, New York, is cited as an instance. In this building Attix wire was used by the permission and with the approval of the New York Board's superintendent before the Attix wire resolution was passed. There were also many other defects and deficiencies in the installation. The same state of things existed in the case of Dennett's restaurant, at 353 Fulton street, Brooklyn. The Bureau of Electrical Inspection, representing twenty-one leading companies and of which Mr. Fremont Wilson is chief, looks with strong disfavor upon the manner in which the superintendent of the inspection department of the New York Board seems often to suspend the rules or grant special permission for their violation. The electric installations of the two buildings above mentioned were condemned by the Bureau and re-wiring ordered in both cases. The Bureau insists upon the rigid enforcement of the standard rules. If, as some suppose, the New York Board passed its much-criticised resolution in order to issue its certificates in these cases and fortify itself against any liability for damages on account of them, we should say (from a knowledge of the risks mentioned, and others as well) that the framers of the Attix wire resolution had bungled. Without the passage of that resolution both the Cambridge Hotel and Dennett's Brooklyn restaurant must have been re-wired. By virtue of the resolution the use of Attix wire in place of the conduit system has the approval of the New York Board; but such are the restrictions imposed upon its use by the terms of the said resolution that the installations of both the risks mentioned will yet have to be amended at considerable cost. To make clear we cite the resolution:

Resolved, That the superintendent be authorized, until further notice, to approve the use of the Attix tube and wire, when equal in quality and insulation to the samples submitted to this Board, and tested under the same conditions where tubing would be permitted; provided that there is no splicing or tapping of the wire, but that its introduction shall be in all cases by the loop system; that in new buildings when necessary to carry it between floor and plastering it shall be through holes bored in the beams, not less than two inches apart, a single conductor in each hole, out of the reach of nails; and in old buildings where necessary to carry it within the reach of nails it shall be protected by some device from perforation; and provided further that the wires and tube be carried intact into the cut-out boxes, and that in no case shall the outer covering be removed before introducing the core wire into the cut-out box.

The equipment of the Cambridge Hotel under this resolution would be classed as that of an old building. Many wires in this building, imbedded in plaster or drawn under floors, are not protected in any way from perforation. Therefore to make the equipment conform to the requirements of the resolution quoted above, either there must be a large amount of re-wiring done, or the wires now installed must be protected by metal plates—a costly method. Similarly, the equipment of Dennett's Brooklyn restaurant does not conform to the requirements of the Board's new rule expressed in the clause between the second and third semicolons. Wires are drawn beneath floors, a number through a single hole bored in the beams and with no protection from nails—which easily penetrate Attix wire. So the building must be practically re-wired to bring the equipment up to the New York Board's Attix wire resolution. And so it seems in order to ask whether that rule is to be enforced in the letter and in the spirit of its requirements.

ARMATURE WINDINGS OF ELECTRIC MACHINES.

This is the title of a new book just published by D. Van Nostrand Co., of New York. The authors of the book are H. F. Parshall and H. M. Hobart. In size it is a quarto volume; has 165 pages of descriptive letter press; 140 full page plates and 65 tables. Price $7.50.

Sent postpaid on receipt of price. Address Electrical Age Publishing Co., World Building, New York.

THE LONG ISLAND TRACTION COMPANY.

The committee which has been engaged for several weeks in devising a plan of reorganization for the Long Island Traction Company, which holds the lease of the Brooklyn Heights Railroad, has virtually concluded its task, and on May 31 a report was submitted to the directors. It is understood that an assessment of nearly $10 will have to be made on each share of the stock in order to enable the company to hold the lease of the big trolley system. Ex-Gov. Flower, who recently became largely interested in the company, said that the road was in bad shape, and that there was going to be a radical change in the management. It is understood that Mr. Lewis will soon retire from the Presidency, but that he will be continued in some responsible place. For the purpose of forcing an assessment on the stock the present assets of the company are to be sold to the new organization.

THE SUNNY SOUTH.

In order to present to the world the remarkable increase in the number of cotton mills being built in the South and the great activity which attends this industry at present, the *Manufacturers' Record*, of Baltimore, issues this week a Special Cotton Mill Edition, in which the situation is treated from its various standpoints by the most noted textile and other experts. Statistics are given showing the number of mills under construction in the principal manufacturing districts, while all the various features peculiarly favorable to this industry in the South are reviewed at length. This is the most complete digest of the subject which has ever been published, and the scope of this issue and its distribution is probably the most important single undertaking which any paper has ever carried through in behalf of the South. Mr. R. H. Edmonds, the editor and general manager of the *Manufacturers' Record*, succeeded in getting some of the ablest experts of New England to contribute special articles showing the South's superior advantages for cotton manufacturing, thus making this issue carry more weight than if the South's claims had been presented only by Southern people. Mr. D. M. Thompson, for many years manager of a New England mill company that operates 420,000 sprindles, the largest mill company in America, and now president of the Corliss Engine Works, writes very strongly in favor of the South's pre-eminent advantages for cotton mills. Mr. C. R. Makepeace, a leading New England cotton mill architect, and Mr. A. B. Shepperson, the cotton statistician, take the same view. Mr. F. E. Saunders, of Lowell, proves by the official reports of the United States Weather Bureau, that in average mean temperature and humidity, the South's climate is much superior to that of Massachusetts for the manufacture of fine cotton goods.

"A WORD TO THE WISE IS SUFFICIENT."

The following is a copy of a letter received by us. This letter tells its own story, and what makes it more telling is that it is entirely unsolicited :

"New York, May 31, 1895.

Electrical Age Pubishing Company,
New York City.

Gentlemen:—Allow me in justice to yourselves and our company, to state the results of the article published in The Electrical Age of April 27, in reference to our Cinge Cutting Comb, in which you told the public how the hair could now be cut by electricity and singed at the same time.

"Of course the Electric Cinge-Cutting Comb was a new thing and we did not expect that we would receive much notice from an article in an electrical paper, as our goods are, as you know, for the barbers' and hair-dressers' use, and we were not counting on more than a few answers, if any, from your readers. The result has been so surprising, and we need not say pleasing to us, that in justice to you we are now advising you of the result of this courtesy on your part to us.

"We have received 372 letters and 84 postals in answer to this article. We have sold or received the orders for 243 combs, at $15 each, for our type "C" comb, thus making the sales gross $3,645.00 in a trifle over a month.

"We have received letters from all over the United States, Canada, and many parts of Europe, Central and South America, and we assure you that we are more than pleased with the unexpected results we have received.

"You are at liberty to use us as reference at any time and we are in a position to show this correspondence to any unbelievers at any time they may call on us.

"Thanking you for the courtesy you have shown us, and assuring you of our appreciation we are,

"Very truly yours,
"The Bell Electric Coepany,
"Per. F. M. Bell, *Pres. & Treas.*'

MORSE CLUB DINNER.

The Morse Club gave its first annual dinner on May 24, at Jaeger's, on Fifty-ninth street, New York City. The object of the club is to commemorate each year, in an appropriate manner, the sending of the first message. A picture of Professor Morse was hung on the wall. Underneath were the historical words, "What Hath God Wrought?" Among those present at the dinner were Edward Lind Morse, of Lakewood, N. J., youngest son of the great inventor; A. B. Chandler, president of the Postal Telegraph Company; George G. Ward, vice-president and general manager of the Commercial Cable Company; W. H. Baker, vice-president of the Postal Telegraph-Cable Company; Chas. A. Tinker, superintendent Western Union Telegraph Company; Thos. F. Clarke, E. C. Platt and others. Appropriate speeches were made after the dinner.

On May 30, Decoration Day, Professor Morse's statue in Central Park was decorated by the Morse Club.

THE BRUSH COMPANY BUYS THE SWAN LAMP COMPANY.

The British Electric Company, Cleveland, O., has recently purchased the property of The Swan Lamp Manufacturing Company and will manufacture and sell incandescent lamps. The Swan lamp is well known throughout the world, not only because it bears the name of the celebrated electrician, Joseph Swan, but because it is more widely used in foreign countries than any other lamp. The Swan Lamp Manufacturing Company was organized in 1885 and has, until its purchase by the Brush Company, rented factory room from the Brush Electric Company.

The Brush Electric Company's going into the manufacture of incandescent lamps, is a new departure, but one which will meet with the entire approval of the trade.

The new incandescent lamp department of the Brush Company will be under the direct supervision of the superintendent and assistant superintendent, but will be operated by a foreman who has had a long experience in the manufacture of incandescent lamps. The sale of the incandescent lamps and the handling of the business will be done by the different departments of the Brush Company.

JUNE CENTURY.

A notable article entitled "The Discovery of Glacier Bay" in The *Century* for June is the record which that magazine has induced John Muir to make of his discovery of the great Alaska glaciers. It seems strange, considering the present accessibility of this region, that it was not until the latter part of 1879 that these glaciers were known to civilization. The largest of them, and the largest glacier in the world, bears the name of its discoverer. Mr. Muir's narrative has all his characteristic picturesqueness and feeling for nature, and contains a description of a morning seen on the Muir Glacier which is a remarkable piece of descriptive literature. The article is illustrated by an engraving of Thomas Hill's painting of the Muir Glacier made for the explorer, and by drawings by John A. Fraser after sketches made by Mr. Muir in the course of his tireless investigation of this wonderful region.

A RARE CHANCE TO INVEST.

An electrician with $3,000 or $4,000 cash can find a remunerative use for it by communicating with Mr. G. L. Hubbell, of Waukon, Iowa. Mr. Hubbell owns the electric light franchise in a growing town of 2,000 population, but not being familiar with the business desires to arrange with some one to take an interest and manage the plant, guaranteeing receipts of $300 to $400 a month.

CANADIAN ELECTRIC RAILWAYS ACT.

The Electric Railways Act of 1895, contains provisions that are intended to prevent stock watering and the other objectionable practices of corporations. All shares of stock will be deemed to have been issued for and held subject to the payment of the whole amount in cash. The exact disposition of the capital must be set forth in detail —how much for promotion expenses, for surveys, plans and estimates. The balance of the capital is to be applied in making, equipping, completing and maintaining the road. No director may be an employé of the company, nor interested in any contract under it. Electric companies are required to make reports of the government, in which the division of capital into ordinary and preferred shares, the amount of bonds, municipal loans, bonuses, subscription to shares and bonds, and all sources of capital, must be shown. The actual amount of cash paid in, as well as the actual cost of stock ; the earnings, and a summary of working expenses, are to be included in these reports.

Where the Bell Company Stands. — "The position of the Bell Telephone Company," said a gentleman well known in the trade, "reminds me of the man who was trying to tell another what the uvula, at the back of the mouth, was for. 'That thing that hangs down,' he said, 'flops around and separates the solid food from the liquid, when we eat and drink.'

"'What a devil of a flopping it must do,' exclaimed the other, 'when we eat mush and milk.'

"There are so many new telephone companies springing up here and there that the monopoly will have a devil of a flopping to do to keep its end up."

Telephone Notes.

The Mutual Automatic Telephone Company proposes to establish a system in Buffalo. It will rent instruments at $30 a year for residences and $36 a year for business purposes.

The Connecticut Legislature is investigating telephone rates in that State. There is general dissatisfaction with the service.

TELEPHONE PATENTS ISSUED MAY 28, 1895.

TELEPHONE CENTRAL STATION. Gaston d'Adhémar, Paris, France. (No. 540,012.)

ELECTRICAL EXCHANGE. Alexander E. Keith, Frank A. Lundquist, John Erickson and Charles J. Erickson, Chicago. (No. 540,168.)

OHIO TELEPHONE ASSOCIATION.

About sixty representatives of local telephone companies in Ohio recently met and organized the Ohio Telephone Association. Letters from companies not represented were read, offering co-operation in the work proposed. The following-named officers were elected :

President—James M. Thomas, Chillicothe.

Vice-presidents—Charles Parrott, Columbus ; Jason Blackford, Findlay ; Harry D. Critchfield, Mt. Vernon.

Secretary—James K. Hamill, Newark.

Assistant Secretary—Caleb S. McKee, Columbus.

Treasurer—Newton Leggett, Marysville.

Executive Committee—George W. Sinks, Columbus ; F. L. Beam, Mt. Vernon ; H. H. Weller, Cambridge ; Jerome Quinn, Washington C. H., and L. P. Lewis, Delaware.

ORGANIZING TO FIGHT THE BELL MONOPOLY.

Mr. J. E. Keelyn, president of the Western Telephone Construction Co., Chicago, has taken the initiative in a movement looking to the organization for mutual protection of companies manufacturing independent telephone apparatus. Mr. Keelyn invited such companies to send a representative to attend a meeting in Chicago with that object in view. The call for the meeting set forth the following facts :

"The probable effect that will obtain in the future respecting the form of order to be entered by the United States Court of Appeals in the Berliner case at Boston requires the earnest and urgent attention of all those expecting to be engaged in the manufacture or production of telephone apparatus.

"The further necessity for preparing for the promised onslaught of the Bell people calls for immediate organization toward a peaceful conduct of legitimate telephone business, and the maintenance of the legal and business rights of those engaged in it.

"This has suggested the prompt meeting of interested parties If you desire to be identified with this organization, it will give the writer pleasure to have your prompt advices to that effect."

The meeting was to have been held on June 3, and we understand that there was the promise of a large attendance.

BAXTER MOTOR CO'S. PLANT SOLD.

Jesse N. Hilles, Baltimore, Md., has purchased the Baxter Electric Motor Co.'s works in Baltimore, paying therefor $25,000. It is stated that the plant will be continued in operation. It is worth $100,000.

New York Notes.

OFFICE OF THE ELECTRICAL AGE,
WORLD BUILDING, NEW YORK,
JUNE 3, 1895.

J. H. Rhotehamel, president of the Columbia Lamp Co., St. Louis, Mo., is in New York.

Second-Assistant Postmaster-General Charles Neilson was in the city a few days ago conferring with Postmaster Dayton concerning the carrying of mails on the Broadway and Third Avenue cable roads.

Mr. W. H. Mackay has been appointed New York representative of the Columbia Lamp Co., of St. Louis. His office is in the Havemeyer Building. Mr. Mackay succeeds Mr. C. I. Hills, who represented the Columbia Company for about a year. Mr. Hills has accepted a position with the Perkins Switch Co., of Hartford.

The affairs of the Lewis & Fowler Mfg. Co., and the Lewis & Fowler Girder Rail Company are being investigated by the Kings County Grand Jury. The companies have been in the hands of a receiver for some months, and mismanagement is alleged by the creditors. It is also charged that dividends were paid after it was known that the companies were bankrupt.

The annual meeting of the stockholders of the New York Mutual Telegraph Company, one of the leased tributaries of the Western Union Company, took place in the rooms of the latter on May 29. The only business transacted was the reëlection of the old Board of Directors, consisting of the following : Thomas T. Eckert, John Van Horne, George J. Gould, John G. Moore, Russell Sage, Grant B. Schley, E. R. Chapman, R. M. Gallaway, J. Seaver Page, and A. H. Calef.

Mr. Milton F. Adams has taken the New York agency of the Carborundum Company, of Monongahela City, Pa. Mr. Adams, with characteristic enterprise, last week employed several men to perambulate Broadway and distribute small cards coated with this substance, to be used as cutlery sharpeners. The men wore high hats sprinkled with carborundum dust, which sparkled like diamonds. They gave away 50,000 samples. Mr. Adams is introducing two of the Carborundum Company's products, which will become popular. They consist of a knife-sharpener and neat hone for sharpening scissors and pointing needles. Mr. Adams' office is at 5a Edison Building, New York City.

W. T. H.

Street Railway Notes.

It is reported that the Auburn and Opelika Railway Co., Opelika, Ala , will build a power plant.

The Anniston City Electric Railway, Anniston, Ala , will be changed to the electric system. O. E. Bigsby is the manager.

M. H. Crump, secretary of the Commercial Club, Bowling Green, Ky., can give information regarding the proposed electric line to be built in that place, for which equipment and material are now required.

The Clarksville Street Railway Co., Clarksville, Tenn., is considering the advisability of adopting the trolley system on its lines.

Mayor E. H. Dial, of Meridian, Miss., may be addressed for particulars regarding the construction of the proposed electric road in that place.

Stilson Hutchins, Washington, D. C., is interested in the project to build an electric railroad from Washington to Cabin John Bridge.

The Park City Railway Company, Bowling Green, Ky.,

will erect a power plant to operate ten miles of electric railway.

The Danville Street Railroad Company, Danville, Va., is in the market for an electric plant. R. P. Jones, president, may be addressed for further particulars.

The Clarksville City Railway Company, Clarksville, Tenn., is inviting bids for equipment for an electric railway. Address Wm. M. Daniel, president, for further particulars.

A company has been organized in Pittsburgh, Pa., to construct an electric railroad from that city to Beaver Falls. C. I. McDonald, of Pittsburgh, is president; Geo. C. Lashell, secretary and W. T. Treadway, 110 Diamond street, Pittsburgh, solicitor.

The Maryland Electric Company, Baltimore, Md., will erect a new power house. Proposals for the electric equipments are invited.

Mayor Boynton and capitalists of Port Huron, Mich., contemplate the building of an electric railway from Port Huron, along the river, to Algonac, thence to Chesterfield.

By an agreement filed in Albany, N. Y., the Buffalo and Niagara Falls Electric Railway and the Buffalo and Tonawanda Electric Railway have consolidated under the name of the Buffalo and Niagara Falls Electric Railway. Neither of the original roads has yet been constructed.

Possible Contracts.

E. H. Wells & Co., Wellsville, Ohio, will install an electric light plant in their big building.

The Oconto Electric Light and Fuel Co., Oconto, Wis., will enlarge its business and proposes to manufacture telephone instruments.

Robert Hoe, 11 East 36th street, New York, will erect a 10-story office building at 11 and 13 West 28th street, New York. The building will cost $100,000.

New Corporations.

Bell Electric Company, Trenton, N. J., by F. M. Bell, New York City; G. A. Westbrook, Brooklyn; A. S. Robinson, Trenton. Business of company to be carried on in New York City. Capital stock, $100,000.

The Canales Trolley Company, Springfield, Ill., by F. William Canales, Portland, Me.; A. M. Ross, L. Henry Pearse, Boston, Mass. Capital stock, $100,000.

The Plymouth Water, Light and Power Company, Sheboygan, Wis., by H. G. Malone, H. E. Dow and S. J. Foote, with a capital stock of $50,000.

The Northern Electric Company, Norwalk, Ohio, by Parks Foster, of Elyria; George P. Jones, of Findlay, and B. P. Foster, Mayme C. Foster and J. W. Foster, of Norwalk. Capital stock, $25,000.

The Anthracite Telephone and Supply Company, Shamokin, Pa. Capital stock, $10,000.

The Ticonderoga Telephone Company, Glens Falls, N. Y., has been incorporated to operate a line from Addison Junction to Rogers' Rock Hotel, Fort Henry, Chilson, Schroon Lake, Whitehall, Hague, Bolton, Caldwell and Glens Falls. Capital stock, $5,000.

The Home Electric Company, Baton Rouge, La., successor to the Baton Rouge Electric Light and Power Company, by Samuel G. Laycock as president, and C. J. Barrow vice-president, with a capital stock of $100,000.

Wood County Telephone Company, Grand Rapids, Mich., has been incorporated by John A. Gaynor, H. H. Voss and George L. Williams, with a capital stock of $5,000.

The Milwaukee and Waukesha Railroad Company, Milwaukee, Wis., by J. W. Bingham, A. B. Meyers, Max Rosenthal, Chas. Pittlekow and others, to build an electric railroad to Waukesha. Capital stock, $1,000,000.

The Dighton, Somerset and Swansea Electric Street Railway Company, Taunton, Mass., has been organized by Colonel B. D. Davol, president, Fall River; clerk, Orville A. Barker, Taunton; treasurer, S. M. Thomas, Taunton. Capital stock, $60,000.

The Phœnix Construction Company, Indianapolis, Ind., by N. J. Clodfelter, Jacob Frankel, C. M. Waterbury, J. W. Paris and C. A. Meeker. Capital stock, $100,000.

The Citizens' Telephone Company, Indianapolis, Ind., has been incorporated by Andrew E. Reynolds and Carl L. Rost, of Crawfordsville, and George W. Caldwell, of Columbus, for operating telephone lines in Marion, Bartholomew, Jackson and Johnson counties. Capital stock, $15,000.

The Duplex Car Company, Concord, N. H., has been organized by ex-Governor H. A. Tuttle, of Pittsfield, Hon. S. S. Jewett, Laconia, and others. Capital stock, $1,000,000.

South Omaha Water-Works Company, Omaha, Neb., by William Paxton and others, to erect and maintain water-works and electric-light plant. Capital stock, $1,000,000.

La Harp Electric Light & Power Company, La Harp, Ill., by J. R. Crabill and W. O. Butler. Capital stock, $15,000.

The Meridian Light & Traction Company, Meridian, Miss., by L. B. Bradley, S. H. Gehlman and R. F. Cochran. Capital stock, $150,000.

Trade Notes.

The Columbia Incandescent Lamp Company, St. Louis, has just issued a new illustrated catalogue of its lamps. This company makes high grade incandescent lamps for all systems.

The hot weather has given an impetus to the fan business. The Metropolitan Electric Company, 186-188 Fifth avenue, Chicago, are supplying the demand as best they can with their celebrated Dayton Electric Ceiling Fan, Victor Direct-Current Desk Fan and Ries and Scott Alternating Fan. The company will soon deliver to its customers one of the handsomest and most complete catalogues of electrical supplies ever gotten out.

The Metropolitan Electric Company, 186-188 Fifth avenue, Chicago, has recently received some good orders for the Keystone instruments, for which they are the Western selling agents. They guarantee the round type switch-board instruments to be correct within two per cent. and the standard Keystone type within one per cent. The Missouri Light and Power Company, of St. Louis, Mo., have recently placed an order for 136 of these instruments, after making a severe test of all makes now on the market. This speaks well for the quality of the Keystone. The Metropolitan Company reports the demand for their unexcelled Metropolitan incandescent lamp to be on the increase. The reason for this is that the central station manager who operates his plant without the use of meters finds it much more economical, and the consumer using light furnished by a station using the meter system finds his bills much smaller at the end of each month.

WOVEN WIRE BRUSHES.

The Belknap Motor Co., of Portland, Maine, are the patentees and manufacturers of the best woven wire commutator brush on the market.

Electrical and Street Railway Patents.

Issued May 28, 1895.

539,786. Conduit Electric-Railway System. Ferdinand Barrell, New York, N. Y. Filed July 19, 1894.

539,823. Device for Operating Switches for Street-Railways. Gotthelf Paschke, Berlin, Germany. Filed Feb. 26, 1895.

539,825. Electrical Connection. Peter Rieth, Chicago, Ill. Filed Feb. 28, 1895.

539,838. Process of Producing Incandescing Bodies for Electric Lamps. Konrad O. E. Trobach, Pankow, Germany, assignor of one-half to Sigmund Bergmann, New York, N. Y. Filed Apr. 18, 1894.

539,840. Safety System for Railways. Albert L. Ware, Cambridge, Mass. Filed October 15, 1894.

539,849. Electric Motor. John B. Atwater, Chicago, Ill. Filed Sept. 24, 1894.

539,854. Trolley-Breaker. William G. Carey and Augustus A. Ball, Jr., Schenectady, N. Y., assignors to the General Electric Company, same place. Filed Nov. 15, 1894.

539,863. Controller for Electric Search-Lights. Elie F. G. H. Faure, John MacHaffie, and Sam H. Libby, Schenectady, N. Y., assignors to the General Electric Company, same place. Filed Jan. 29, 1895.

539,870. Annunciator. Franklin A. Jennings, Ithaca, N. Y., assignor to the Electric Bulletin Company, Chicago, Ill. Filed Mar. 23, 1893.

539,871. Galvanic Battery. Harry T. Johnson, New York, N. Y. Filed Nov. 10. 1893.

539,876. Stationary Transformer. Walter S. Moody, Lynn, Mass., assignor to the General Electric Company of New York. Filed May 15, 1894.

539,877. Electric-Arc Lamp. John A. Mosher, Chicago, Ill. Filed May 1, 1893.

539,881. Armature-Coil and Method of Making Same. Otto F. Persson and David P. Thomson, Schenectady, N. Y., assignors to the General Electric Company, same place. Filed Oct. 6, 1894.

539 886. Electric Meter. Elihu Thomson, Swampscott, Mass., assignor to the General Electric Company of New York. Feb. 18, 1895.

539,901. Car-Fender. James W. Madden, Brooklyn, N. Y. Filed Aug. 22, 1894.

539,933. Car-Truck. Edward Cliff, Newark, N. J. Filed May 7, 1894.

539,934. Car-Truck. Edward Cliff, Newark, N. J. Filed Dec. 31, 1894.

539,935. Car-Truck. Edward Cliff, Newark, N. J. Filed Dec. 31, 1894.

539,939. Electric Cable. William D. Gharky, Philadelphia, Pa. Filed Oct. 18, 1894.

539,943. Armature-Winding and Method of Making Same. William Hochhausen, Brooklyn, N. Y. Filed Feb. 10, 1888.

539,959 Shade for Electric Lamps. Albert S. Marten, East Orange, N. J. Filed Feb. 11, 1895.

(*Continued on Page* 330)

National Electric Light and Street Railway Associations.

NATIONAL ELECTRIC LIGHT ASSOCIATION.

President, C. H. Wilmerding, Chicago, Ill.; 1st Vice-President, Frederic Nicholls, Toronto, Canada; 2d Vice-President, E. F. Peck, Brooklyn, N. Y.

Members of Executive Committee: E. H. Davis, Williamsport, Pa., (one year); W. R. Gardiner, Pittsfield, Mass.; George A. Redman, Rochester, N. Y.; J. J. Burleigh, Camden, N. J. Next meeting, New York, May or June, 1896.

AMERICAN STREET RAILWAY ASSOCIATION.

Next meeting, Montreal, Que., October, 16, 17 and 18, 1895.

President, Joel Hurt, Atlanta, Ga.; Vice-President, W. Worth Bean, St., Joseph, Mich.; 2d Vice-President, John M. Cunningham, Boston, Mass.; 3d Vice-President, Russell B. Harrison, Terre Haute, Ind., Secretary and Treasurer, William J. Richardson, Brooklyn, N. Y.; Executive Committee, Henry C. Payne, Milwaukee, Wis.; W. H. Jackson, Nashville, Tenn.; D. G. Hamilton, St. Louis, Mo., C. C. Cunningham, Montreal, Canada; J. N. Partridge, Brooklyn, N. Y.

NEW YORK STATE STREET RAILWAY ASSOCIATION.

Next meeting, Albany, N. Y., third Tuesday in September, 1895.

President, G. Tracy Rogers, Binghamton; First Vice-President, John H. Moffitt, Syracuse; Second Vice-President, W. W. Cole, Elmira; Secretary and Treasurer, William J. Richardson; Brooklyn; Executive Committee, D. B. Hasbrouck, New York; John N. Beckley, Rochester; Daniel F. Lewis, Brooklyn.

OHIO STATE TRAMWAY ASSOCIATION.

Next meeting, fourth Wednesday in September, 1895.

President, Albion E. Lang, Toledo; Vice-President, W. J. Kelly, Columbus; Secretary and Treasurer, J. B. Hanna, Cleveland; Chairman Executive Committee, W. A. Lynch, Canton.

MASSACHUSETTS STATE STREET RAILWAY ASSOCIATION.

President, T. H. Cunningham, Boston; Secretary and Treasurer, A. S. Butler, Lawrence; Executive Committee, Samuel Winslow, Alfred A. Glazier, Boston; P. F. Sullivan, Lowell; E. C. Foster, Revere; Horace B. Rogers, Brockton; A. E. Smith, Springfield; Prentiss Cummings, Boston.

THE TEXAS STREET RAILWAY ASSOCIATION.

President, W. H. Sinclair, Galveston; vice-president, C. A. McKinney, Houston; Secretary and Treasurer, C. L. Wakefield, Dallas. Directory: The officers and W. H. Weiss, San Antonio and George B. Hendricks, Fort Worth.

Next meeting, Galveston, third Wednesday in March, 1896.

PENNSYLVANIA STATE STREET RAILWAY ASSOCIATION.

Next meeting, first Wednesday in September, 1895.

President, John A. Rigg, Reading; First Vice-President, Robert E. Wright; Secretary, S. P. Light, Lebanon; Treasurer, W. H. Lanius, York.

THE MAINE STREET RAILWAY ASSOCIATION.

President, W. R. Wood, Portland; Secretary and Treasurer, E. A. Newman, Portland; Executive Committee, W. R. Wood, Portland; George E. Macomber, Augusta; F. M. Laughton, Bangor; Frank W. Dana, Lewiston; Amos F. Gerald, Fairfield.

MICHIGAN STATE STREET RAILWAY ASSOCIATION.

President, W. L. Jenks, Port Huron; Vice-President, W. Worth Bean, St. Joseph; Secretary and Treasurer, B. S. Hanchett, Jr., Grand Rapids; Executive Committee, the Officers and David H. Jerome, Saginaw, and Strathern Hendrik, Detroit.

THE STREET RAILWAY ASSOCIATION OF THE STATE OF NEW JERSEY.

President, Thos. C. Barr, Newark Vice-President, W. S. Scull, Camden; Secretary and Treasurer, Charles Y. Bamford, Trenton; Executive Committee, Officers and C. B. Thurston, Jersey City; H. Romaine, Paterson S. B. Dod, Hoboken.

539,966. Electric Bell. Charles B. Sterling, New York, N. Y., assignor to the Dewey Electric Signal Company, Jersey City, N. J. Filed Mar. 14, 1895.

539,976. Car-Truck. Edward Cliff, Newark, N. J. Filed Mar. 24, 1894.

540,005. Fenders for Street-Cars. John Titley, Pittsburgh, Pa. Filed Jan. 25, 1895.

540,008. Electrical Thermometer. George C. Whipple and Henry E. Warren, Newton, Mass. Filed Dec. 5, 1894.

540,010. Conduit Electric Railway. Frank B. Widmayer, New York, N. Y., assignor of one-half to Charles E. Ball, same place. Filed Aug. 3, 1894.

540,012. Telephone Central Station. Gaston d'Adhemar, Paris, France. Filed June 20, 1894. Patented in France May 10, 1893, No. 230,380.

540,035. Brush-Holder for Dynamo-Electric Machines. Elihu Thomson, Swampscott, assignor to the General Electric Company, Boston, Mass. Filed February 20, 1893.

540,060. Conduit Electric Railway. William E. M. Jackson, San Francisco, Cal. Filed Oct. 25, 1893.

540,063. Safety Car-Fender. Samuel C. Kindig, Baltimore, Md. Filed Oct. 20, 1894.

540,066. Car-Fender. Benjamin Lev, Philadelphia, Pa., assignor of one-half to Nicholas F. Hoffman, same place. Filed Nov. 23, 1894.

540,068. Truck for Street-Cars, De Witt Loomis, Detroit, Mich. Filed Jan. 7, 1895.

540,073. Electric Heater. Charles J. Reed, Philadelphia, Pa., assignor, by direct and mesne assignments to the Reed Electric Company, same place. Filed June 5, 1894.

540,076. Secondary Battery. William L. Silvey, Dayton, Ohio. Filed Jan. 21, 1895.

540,089. Base-Ball-Game-Illustrating Apparatus. Melvin D. Compton, Newark, N. J. Filed Feb. 4, 1895.

540,090. Electric Passenger Register and Recorder. Joseph W. Ellis, Albany, N. Y. Filed Jan. 12, 1895.

540,091. Car-Truck. George B. Esterley, Fall River, Mass. Filed Oct. 6, 1894.

540,101. Car-Fender. Edward L. Kelly, Philadelphia, Pa. Filed Mar. 21. 1895.

540,103. Switch-Adjuster. John Kortan, Jr., Detroit Mich. Filed Nov. 28, 1893.

540,106. Car-Fender. Rafael Mayolini, New York, N. Y. Filed Mar. 6, 1895.

540,120. Fender for Street-Cars. William N. Taggart, Philadelphia, Pa. Filed Jan. 5, 1895.

540,153. Apparatus for Determining Differences Between Phases of Two Electric Alternating Currents. Michael von Dolivo-Dobrowolsky, Berlin, Germany, assignor to the Allgemeine Elektricitats-Gesellschaft, same place. Filed Oct. 27, 1893. Patented in Germany Apr. 14, 1892, No. 68,215; in Switzerland Dec. 12, 1892, No. 6,074, and in England Dec. 15, 1892, No. 23,113.

540,159. Metallic Base for Telegraph or Other Poles. Frank E. Garner, Cornwall, Conn. Filed Jan. 9, 1895.

540,168. Electrical Exchange. Alexander E. Keith, Frank A. Lundquist, John Erickson, and Charles J. Erickson, Chicago, Ill., assignors to the Strowger Automatic Telephone Exchange, same place. Filed Nov. 7, 1894.

540,185. Secondary Battery. Clément Payen, Philadelphia, Pa Filed Aug. 17, 1893.

540,187. Closed-Conduit System for Electric Railways. Herluf A. F. Petersen, Milwaukee, Wis. Filed Mar. 26, 1894.

540,216. System of Electrical Distribution. Ernst G. P. Oelschlaeger, Charlottenburg, assignor to Siemens & Halske, Berlin, Germany. Filed Apr. 6, 1895.

ELECTRICAL AGE

VOL. XV., No. 24. NEW YORK, JUNE 15, 1895. WHOLE No. 422

ESTABLISHED 1883.

Entered at New York P. O. as second-class matter, January 18, 1891.

THE ELECTRICAL AGE PUBLISHING CO., PUBLISHER

TERMS OF SUBSCRIPTION:
One Copy, one year, - - - $3.00
One Copy, six months, - - - 1.50
Great Britain and other Countries, - - 4.00

Cable Address (all Cables,) "Electage," New York.

W. T. HUNT, President F. N. BASSETT, Vice-President
T. R. TALTAVALL, Secretary and Editor.
NEWTON HARRISON, E. E., Scientific Editor.
Canadian Representative, E. W. SAYER, Montreal, Que.

ADDRESS ALL COMMUNICATIONS TO
THE ELECTRICAL AGE PUBLISHING COMPANY,
FIRST FLOOR, WORLD BUILDING.
NEW YORK.

NEW YORK, JUNE 15, 1895.

CONTENTS.

A. I. E. E. NIAGARA FALLS MEETING.

On another page will be found the programme of the Niagara Falls meeting of the American Institute of Electrical Engineers on June 25–29. All of the papers enumerated are of extremely practical character, and these, together with the incidentals of the meeting, should bring out a large attendance. The Niagara Falls power plant is an attraction sufficient in itself to insure the presence of an unusual number. The opportunities to examine and study this famous work will be better on this occasion than could be expected at any other time; therefore, any one who has any interest in this unique plant should make a special effort to see it under the most favorable circumstances. Full particulars of the meeting will be found on page 338 of this issue.

RAILWAY TELEGRAPH SUPERINTENDENTS IN CONVENTION.

The Association of Railway Telegraph Superintendents holds its annual meeting in Montreal during the present week. Some interesting and valuable papers are to be read. This association is composed of practical men who are at the head of one of the most important branches of railroad service.

TELEPHONE PROTECTIVE ASSOCIATION.

In our last issue we announced the calling of a meeting of representatives of independent telephone interests. The meeting was held in Chicago, as noted, and an organization effected. The name adopted for the new concern is the Telephone Protective Association of America. Little will be done until the publication of the opinion of the United States Court of Appeals in the Berliner case, when a meeting will be held in Pittsburgh, and the policy of the new association announced. State organizations of like character are to be encouraged.

THE POSSIBILITY OF THE PRIMARY BATTERY.

Has development in the primary battery reached the highest attainable limit? True, science has defined a boundary beyond which it is impossible to go in this direction with the use of known materials, but has the limit of possibilities been reached? It requires certain chemical combinations to obtain an electric current from a primary battery, and science has determined the best materials to use to produce the strongest chemical effects, and, consequently the greatest amount of electric current. The zinc and sulphuric acid combination gives the most powerful effects, and the ultimate amount of energy possible by such a combination is 3006 British thermal units. This value, however, can never be approximated in practice on account of the losses of reaction, internal resistance, etc. After deducting all of these losses, taking the Smee cell as an example, there remains less than 900 British thermal units available for practical work. The claims of many new primary battery inventors for the efficiency of their particular battery are often grossly exaggerated, and Prof. Henry Morton, in an article in the June number of *Cassier's Magazine*, shows in figures just what is possible and what is not possible in the primary battery field. In the best form of batteries, he says, an allowance of one horse-power for each pound of zinc consumed per hour would be a liberal one, after deducting losses. He does not think it possible to further improve the class of batteries under consideration. The only possible way of attaining greater results from the primary battery would be in the use of some other reaction than that between zinc and sulphuric acid. But nothing of the sort has ever been accomplished, and from what is known of the combining or thermal equivalents of the available elements little can be hoped for in that line. A pound of zinc per horse-power per hour, he states, is an outside figure for efficiency, and when any one asserts that any particular battery does better, there must be some mistake or fraud about it. We give on page 337 an abstract of Prof. Morton's article, which, apart from its general bearings, has considerable intrinsic value.

CONVENTION OF THE ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS.

The fourteenth annual meeting of this association, which will be called to order at the Windsor Hotel, Montreal, on June 12, promises to be a largely attended and interesting one. The number and character of papers prepared insures an interesting meeting, and the social part of the convention will be an enjoyable one. Superintendent J.

WINDSOR HOTEL, MONTREAL.

W. Fortune, of the Chicago and Grand Trunk Railway, Chairman of the Committee of Arrangements and Exhibits, has prepared a well-arranged programme for the entertainment of the visitors, and the latter will no doubt feel amply repaid for their visit to the capital of the Dominion. Montreal is a very interesting city to visit, and the people always welcome a society from "The States" with generous hospitality.

The papers to be read at the meeting are on subjects that are of the greatest interest to the superintendents, and these papers, together with the incidental discussions, will no doubt bring out many valuable facts and suggestions. The fact that the papers have been prepared and placed in the hands of the members in advance will enable the latter to better fit themselves to take part in the discussions. This plan is being generally adopted by organizations of this class, with very good results.

Following is a list of the papers to be read:

Remedies for Inductive Disturbances in Telephone and Telegraph Lines, by Thomas D. Lockwood, of Boston; Practice of Placing Responsibility on the Young and Inexperienced, by Ralph W. Pope; Trolley Currents and Automatic Signals, by G. H. Thayer; The Michigan Central System and its Operators, by E. E. Torrey, of Detroit; Standard Construction of Telegraph Lines, by W. F. Taylor; Line Construction, by C. A. Parker; Uniformity, by J. C. Ford; Some Suggestions on the Social and Moral Conditions of Railway Telegraphers, by R. B. Gemmell; Evolution, by J. Q. Mason; Water-Power in Connection with Electricity and Electric Locomotives in Railroading, by J. J. Burns.

FACTS OF INTEREST ABOUT MONTREAL.

Montreal, the Canadian metropolis, lies on the left bank of the St. Lawrence river, 600 miles from its mouth, 180 miles above Quebec, 200 below Lake Ontario and 335 north of New York city. The city is located on an island formed by the two arms through which the Ottawa river enters the St. Lawrence. It derives its name from Mont Real (or Royal) which rises immediately behind the city to a height of 750 feet.

Montreal is a well-built city. Of its public buildings the most remarkable are the Roman Catholic parish church of Notre Dame and the English Cathedral. McGill University was founded as a college in 1811, erected a University in 1821, and reorganized and enlarged in 1852.

The largest public park in the city is the Champ de Mars.

The harbor of Montreal extends for nearly three miles, from the village of Hochelaga to the famous Victoria tubular bridge which crosses the St. Lawrence. This bridge is two miles long and is supported by 24 piers.

It is said of Montreal that "it has the splendor of Edinburg as well as the picturesqueness of Constantinople, all under the clear Canadian sky, as blue as that of Italy."

CORRIDOR, WINDSOR HOTEL, MONTREAL.

Montreal covers the site of the Indian village named Hochelaga, founded by Jacques Cartier, when he arrived, in 1535.

The city has always been the entrepôt of the trade of the Northwest, from its foundation up to the present time, and its growth has been in unison with its development as a trade centre.

The city has a population of about 250,000, and is celebrated for its winter sports.

Among the points of interest in and about the city is Mount Royal Park, on Mount Royal, and Lachine Rapids, nine miles above the city. "Lachine" is the French for China, and was the name bestowed 350 years ago when French sailors hoped to reach China by passing up the St. Lawrence, which they thought offered a Western route to the Flowery Kingdom. Lachine Rapids are reached from the city by train or steamers; the latter go to a point above the rapids, passing through locks in the canal, and then descending the rapids on the down trip. The rush through the turbulent waters is attended with exhilarating excitement, and is an experience that all visitors to Montreal should not fail to enjoy.

At the third meeting, on September 17, 1884, Charles Selden was elected president and E. C. Bradley, vice-president.

The fourth annual meeting was held in Cleveland, Ohio, on June 17 and 18, 1885. Messrs. Phelps and Tappan gave explanations of their induction systems of telegraphic communications from moving trains. A committee was appointed to devise a symbol to be used in place of the long dash for ciphers. At the close of the meeting President Selden was presented with a gold-headed cane. The election resulted in the selection of C. W. Hammond as president, and Geo. L. Lang, vice-president.

St. Paul was the place of the 1886 meeting, and June 16, 17 and 18 were memorable days. Thirty-four members were present. The Chamber of Commerce and the Jobbers' Union were lavish in their attentions to the association, giving the members and their ladies a fine trip to Duluth and the Apostle Islands by rail and boat. Lieut. Tappan gave a practical illustration of the Edison induction system on a moving train between St. Paul and Minneapolis. A. R. Swift was elected president, G. L. Lang, vice-president.

TELEPHONE EXCHANGE, MONTREAL.

The quaint city of Quebec is 180 miles east of Montreal. It should be visited by all who can spare the time to make the trip. There is no city on the American continent like it; its narrow, steep streets, and its antique houses give it a very romantic air and strongly remind one of some of the old cities of Europe.

HISTORICAL SKETCH OF THE ASSOCIATION.

The Association of Railway Telegraph Superintendents was organized in Chicago, on November 20, 1882, the officers for the first year being W. K. Morley, president; Wm. Klein, vice-president, and C. S. Jones, secretary.

The second meeting was also held in Chicago, at the Grand Pacific Hotel, on June 13 and 14, 1883. Committees reported on service list and form of dismissal card. Thirty railroads were represented at this meeting. Mr. W. K. Morley was re-elected as president for the second year; Charles Selden, vice-president, and P. W. Drew, secretary and treasurer.

The next meeting was held in Boston, July 13 and 14, 1887. Thirty-one members present. A unique gavel was presented to the association by retiring President Swift. The committee on cipher symbol presented an exhaustive report and were discharged, their labors and the efforts of the association having come to naught. A display of electrical devices was, for the first time in the history of the association, shown and their operations explained by their respective representatives. G. L. Lang was elected president; G. C. Kinsman, vice-president.

The seventh annual meeting was called to order July 11, 1888, at the Murray Hill Hotel, New York, by President Lang. Twenty-nine members present. Commander Brown, of the Naval Observatory, Washington, was present and explained some of the features in connection with

the distribution of standard time. A paper on electric welding was read. A large exhibit was shown of various electrical devices, including Edison's phonoplex in operation. G. C. Kinsman was elected president, C. A. Darlton, vice-president.

The 1889 meeting was held at Washington, October 16 and 17. Twenty-five members present. A paper on train electric lighting was read by Chas. Selden. The members were received by President Harrison, in the East Room of the White House. C. A. Darlton was elected president, Geo. T. Williams, vice-president, and a list of honorary membership in the association voted.

The ninth annual meeting assembled at Niagara Falls, June 18 and 19, 1890. This meeting was remarkable in the number of papers read and the interesting discussions of them that followed, by which the time of the association for two days was fully occupied, evening sessions being held instead of afternoon. The papers were "Block Signals," by Robt. Stewart; "Increasing Traction of Locomotives by Means of Electricity," by Chas. Selden; "Some Details in the Manipulation of Block Signals," by W. W. Nichols; "Application of Electric Lights at Wrecks," by W. F. Taylor; "Electric Lighting in Railroad Service," by M. B. Leonard; "Train Dispatching, Its Use and Abuse." by G. C. Kinsman; "Correct Time, How Shall We Maintain It?" by H. S. Pritchett.

The long distance telephone was exhibited and conversation held with parties in Albany and New York. Geo. T. Williams was elected president, Geo. M. Dugan, vice-president.

June 17 and 18, 1891, found the association at Cincinnati. Thirty-seven members were present. The constitution was changed, making dues $5 per annum. C. S. Jones was elected president; L. H. Korty, vice-president. Papers on "Block Signal," by G. L. Lang, and on the "Quadruplex," by U. J. Fry, were read.

The eleventh annual meeting was held at Denver, June 15 and 16, 1892. Forty-seven members were present and a meeting unsurpassed for interest and enjoyment was held. Papers from Thos. A. Edison, Chas. Selden, J. B. Stewart, J. W. Lattig, S. S. Bogart, Prof. W. A. Gardner and T. D. Lockwood were read L. H. Korty was elected president and U. J. Fry, vice-president.

The twelfth meeting was held at the Plankinton House, Milwaukee, Wis., on June 20 and 21, 1893. In the absence of President Korty, Vice-President Fry occupied the chair. A paper by L. H. Korty, on "The Commercial Telegraph Error Sheet; Its Cause, Adjustment and Prevention, From a Railroad Standpoint," was read. Other papers read were on "Batteries," by G. L. Lang; "Energy," by Thos. D. Lockwood; "Introduction of Telegraph Wires into Offices With Special Reference to Line or Way Offices," by E. R. Adams; "The Railroad Signal: Signaling and its Relation to the Telegraph Department," by J. W. Lattig

The proceedings of this meeting were reported directly on the phonograph and transcribed therefrom. At the conclusion of the meeting most of the members visited the World's Fair in Chicago.

Mr. U. J. Fry was elected president and O. C. Greene, vice-president.

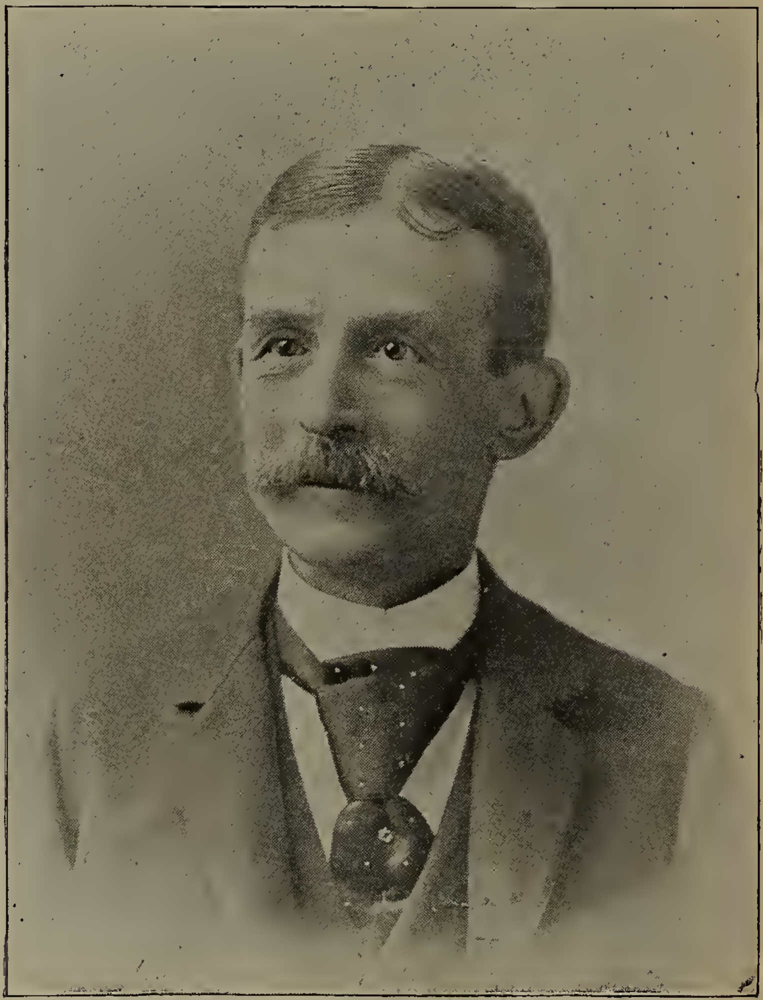
The thirteenth meeting was held at the Cadillac Hotel, Detroit, Mich., on June 13 and 14, 1894. Thirty-six members were present. Papers were read by J. W. Lattig, on "Machine Currents and Railroad Telegraph Lines:" A. R. Swift; R. J. M. Danley, on "The Protection of Highway Crossings With Electric Bells" (read by G. C. Kinsman); A. R. Lingafelt, on "The Universal Inefficiency of the Ordinary Telegraph Operator to Properly Test and Locate Wire Trouble;" Charles Selden, on "The Telephone and the Railroad;" L. S. Wells, on "The Manner in Which Buildings Should be Protected Against High Potential Currents;" G. L. Lang, on "Fuse Wires as Protectors;" M. B. Leonard, on "The Electric Lighting of Railway Trains." O. C. Greene was elected president and E. R. Adams, vice-president.

Owing to the death of Vice-President Adams early in 1895, M. B. Leonard was appointed to fill the vacancy.

And here we are!

OSCAR C. GREENE, PRESIDENT.

The present incumbent of the presidential chair of the Association of Railway Telegraph Superintendents, Mr. Oscar C. Greene, is a native of the Buckeye State. He was born in Summit County, Ohio, in 1842, and lived in that State until 1863. He learned telegraphy in Bellefontaine, Ohio, in 1861, and was an operator at that point for two years, when he acted on Horace Greeley's advice and went West, to Hudson, Wis. He was engaged in other business during the first year of his residence in Wisconsin, and in 1864 and 1865 was in the service of the North-Western Telegraph Company at St. Paul, Minn. He did considerable line-construction work for this company, and in 1866 he entered the service of the North-Western Packet Company. Later in the same year Mr. Greene was appointed superintendent of telegraph of the St. Paul and Pacific Railroad, now part of the Great Northern Railroad Company.



OSCAR C. GREENE, PRESIDENT.

In 1872 Mr. Greene resigned his position with the Great Northern Company to accept that of superintendent of telegraph of the Northern Pacific Railroad Co., with headquarters at St. Paul, which position he still holds.

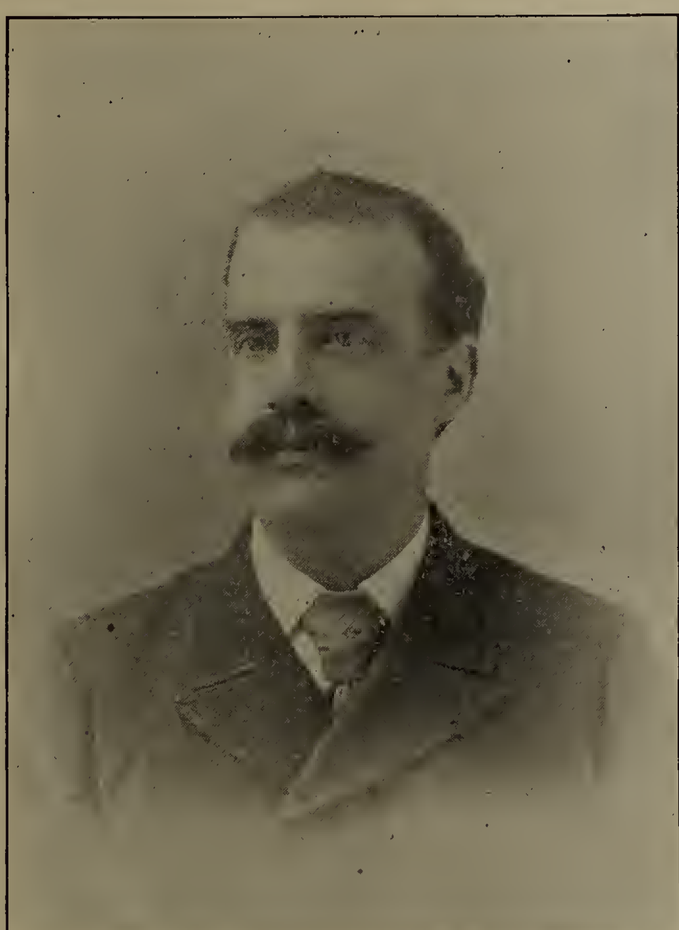
Mr. Greene is an active worker in the association's behalf. He was elected for the year 1894–95 at the Detroit Convention in June last. He is a very pleasant gentleman to know, and possesses rare executive ability. He is a regular attendant at the conventions, and is one of the association's counsellors.

PRODUCING ALUMINUM.—A new process of obtaining aluminum is described in the *Zeitschrift fuer Augewandte Chemie.* It consists essentially in decomposing the double chloride of sodium and aluminum, by melted sulphide of sodium, sulphide of aluminum and chloride of sodium being formed. Fluoride of aluminum may be made by an analogous process, in which clay may be used. Treated with sulphuric acid, the clay gives sulphate of alumina, which is afterward melted with fluoride of sodium. The reaction gives fluoride of aluminum, or kryolith, according to the proportion of sodium fluoride employed. There is obtained from it sulphide of aluminum, which, submitted to electrolysis, gives in its turn aluminum.

M. B. LEONARD, VICE-PRESIDENT.

Mr. Leonard is one of the leading members of the Association of Railway Telegraph Superintendents. He was born in Philadelphia on June 14, 1856, and removed to New York when quite young. He passed through preparatory and classical courses at the Jesuit College of St. Francis Xavier, on West 16th street, New York City, and afterwards took special courses in chemistry and electrometallurgy under Dr. Howland. He then spent three years in mechanical engineering work at the Delamater Iron Works in New York City.

In 1875 he turned his attention to electricity, with which science he has ever since been identified in one capacity or another. In that year he entered the service of the Western Union Telegraph Company, becoming an operator at 145 Broadway, then the headquarters of that company.



M. B. LEONARD, VICE-PRESIDENT.

He afterwards worked in other offices for the same company until 1878, when he resigned to accept a position with the New York Central Railroad at Rochester, N. Y. He was, in 1879, appointed chief clerk of the Coal Department of the Erie Railway at Elmira, N. Y., and in 1880 was transferred to the New York office and appointed secretary to the traffic manager of the same company.

Mr. Leonard entered the service of the Chesapeake & Ohio Railway Company early in 1881 as chief clerk of the transportation department, and was appointed superintendent of telegraph of the same company in October of the same year. He still holds this position, acting in a joint capacity for the railway and Western Union Telegraph Companies. His headquarters are in Richmond, Va.

Mr. Leonard is an inventor of considerable note. The Leonard Block System of Signals, now largely used on the Chesapeake & Ohio Railway, and other roads, is one of his most important inventions. This system is covered by no less than eight patents. He is also the inventor of an electrical heating apparatus which has both merit and promise, and he is now developing a system of air brakes, Both of these inventions are also patented.

While a thoroughly practical man, Mr. Leonard gives some of his time to the finer things of life. He is an accomplished musician, and for the past ten years has served as organist in St. Peter's Cathedral in Richmond.

By reason of long practical experience in electrical and railroad matters Mr. Leonard is abundantly qualified to take a leading part in the proceedings at the annual conventions of the association. His papers are always full of valuable and original information, and are widely copied and commented upon by the technical press.

His paper on Lighting Railroad Trains by Electricity, which was read last year at the Detroit convention, attracted wide attention in the electrical and railway worlds, and was one of the best papers ever written on this important subject.

Mr. Leonard was appointed vice-president during the past year, to fill the vacancy caused by the death of Mr. E. R. Adams, superintendent of telegraph of the Reading Railroad.

P. W. DREW, SECRETARY-TREASURER.

The courteous and efficient secretary and treasurer of the Association, Mr. P. W. Drew, is a native of the Green Mountain State, being born in Burlington, Vt.

On April 1, 1861, he entered the telegraph service as messenger in Quincy, Ill., for the Illinois and Mississippi Telegraph Company, and in a year and a half—October, 1862—he was appointed agent and operator at West Quincy, Mo. He continued advancing in proficiency as the years rolled by, and in December, 1866, he received the appointment of chief operator of the Hannibal and St. Joe R. R., with headquarters at Hannibal, Mo.

In May, 1869, he was appointed superintendent of telegraph for the same road, and in 1872 was made division superintendent, occupying the latter position until 1877.

P. W. DREW, SECRETARY-TREASURER.

Mr. Drew went to Chicago on April 15, 1878, as superintendent of telegraph and master of transportation for the Chicago and Eastern Illinois R. R., which position he held until September, 1892, when he received the appointment of chief operator of the Northern Pacific Railroad, with headquarters in Chicago.

In September, 1894, he was appointed superintendent of telegraph of the Wisconsin Central R. R., which position he still holds.

Mr. Drew has been secretary and treasurer of the Association of Railway Telegraph Superintendents since June 13, 1883, when he was elected at the Chicago meeting. He has been re-elected every year since and still fills this position with honor to himself and the association.

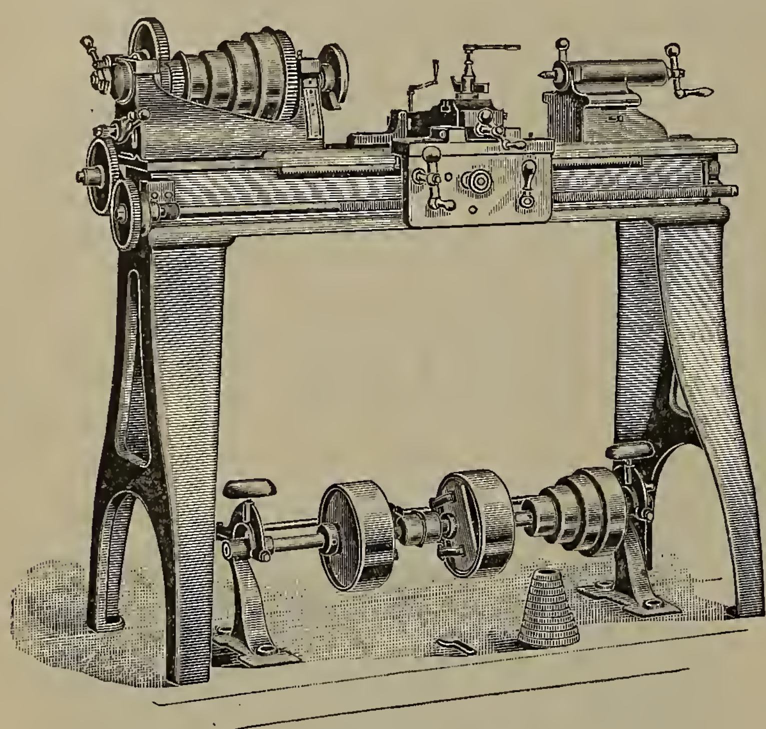
Mr. Drew is a gentleman in every sense of the word, and is highly esteemed by all of his fellow members in the Association. He is loyal to the association's interests and has great faith in its possibilities.

MANN ENGINE LATHE.

The accompanying illustration is of the improved Mann 11-inch engine lathe. This lathe is made from entirely new patterns, and in its construction the best of materials are used. It is designed for use in the production of small work where accuracy is required, and all parts are arranged for quick and easy operation.

The lathe is provided with raise and fall gibbed rest, and is furnished with a splined lead screw to which is attached a friction feed for turning. It can be furnished with plain gib or raise and fall rest, and with countershaft with tight and loose or friction pulleys. The spindle is hollow and made of high carbon steel.

This lathe is made by the Prentiss Tool and Supply Company, 115 Liberty street, New York, and 59 South Canal street, Chicago, and is especially adapted to electrical work.



MANN ENGINE LATHE.

PRINCIPLES OF DYNAMO DESIGN.

BY

Newton Harrison, E.E.

(*Continued from Page* 324.)

If the field remains uniform in a dynamo so that the changes of current in the armature do not perceptibly affect it, then the E. M. F. will be in direct proportion to the length of wire used as inductors, if the speed be constant. If 10 feet of wire on the outside of an armature generates four volts, then 20 feet under the same conditions would generate eight volts. The machines used in daily practice of the same general type use about the same strength of field, so that the term volt-feet could almost be used to designate the length required for the production of a given E. M. F.

There is no surety attached to such a method, however, unless the strength of field remains the same in all cases, and in those armatures employing teeth it is very unlikely that even a fair degree of approximation could be arrived at by such a method. The surest system is that of calculating the exact number of inductors by the method already given. The diagram of a steam engine could not describe more accurately the internal conditions prevailing than the curve of a dynamo showing the relation between the E. M. F. and current. In all machines the best indication of their proper and practical action is a curve showing the relation between two factors of its output. In the dynamo the pressure is not a constant quantity, as might be supposed; it is subject to changes brought about by impressed causes whose direct effect is to cut it down—to effectually decrease it.

When a dynamo is at full load the current production has reached its practical limits, and unless some outside means be taken to keep the E. M. F. constant it will drop to a very perceptible degree. The curve showing the fall of pressure with every increase of current is therefore an exact indication of the regulation with different current outputs or loads. To draw the characteristic of a shunt-series and compound-wound machine would be to delineate the action of the three important classes of machines.

In each of these above-mentioned classifications there is a distinct object in view, which necessitates the special winding as each particular case may demand. In them all the E. M. F. is produced either as a variable or a constant quantity. If a series machine the E. M. F. constantly varies, because the requirements of practice are such that the majority of them, if used as dynamos, are called arc light machines, and as such must preserve a constant current in the line and a means of automatically varying the E. M. F. with every change in load. The shunt machine, on the contrary, demands the contrary; it calls for a constant pressure in the line and supplies a current which, while varying between wide limits, still tends to preserve a uniformity of pressure. While this is not actually achieved in a strict sense, it is from a general standpoint.

The winding by an additional set of turns becomes what is now called compound winding. The compound-wound dynamo preserves within a volt or two the same pressure by means of this added or series winding, and the series or arc machine usually used for high tension circuits has a brush-shifting device or other means for the preservation of a constant current in the circuit. Motors may be placed under these heads also, namely: Constant current and constant potential machines, according to the work they are supposed to do.

Self-induction.—Before a further development of this subject takes place it will be advisable to consider under the head of the generation of E. M. F. a phenomenon which is forever linked as part of the development of E. M. F. in any circuit either as the pressure rises in value or as it falls, and which reacts upon it in such a manner as to cause, in certain cases, a fault of an almost ineradicable nature. Joseph Henry, in experiments he was conducting, noticed upon the breaking of a circuit the presence of a spark, caused by this operation, and apparently related in no respect to the original source except as a secondary effect. This was called in those days the 'extra current,' although in fact it might have been better called the extra pressure. It seems that the growth of a current in any circuit means the immediate existence of an opposing E. M. F., which prevents the sudden inrush of current to such an extent as to cause the passage of a sensible period of time before the flow becomes of uniform and normal strength. Upon the sudden opening of any circuit the secondary E. M. F. acts in series with the applied E. M. F., and develops to such an extent as to enable the current to leap across a considerable distance and cause, if it be of great strength, an arc of destructive tendencies.

(*To be continued*).

CAUSE OF THUNDER.

The lightning spark heats the air in its path, causing sudden expansion and compression all around, followed by as sudden a rush of air into the partial vacuum thus produced. If the spark be straight and short the *clap* will be short and sharp; if its path be a long and crooked one, a succession of sounds, one after the other, with a characteristic *rattle*, will be heard, followed by the echoes from other clouds. The echoes have a rolling and rumbling sound.

THE MAXIMUM POSSIBLE EFFICIENCY OF GALVANIC BATTERIES.*

BY HENRY MORTON, PH. D.

To discuss this question in an exact and numerical manner, it will be necessary to indicate with precision what class of batteries are referred to, and the writer would, therefore, say at the outset that he refers only to those which long experience has proved to be the most efficient in supplying large currents, excluding those of the Leclanché type, which yield only feeble currents.

In all the batteries here referred to there are the following common features: 1st, the energy is derived from the combination of zinc with dilute sulphuric acid; 2d, the supply of oxygen required for this combination is obtained by the decomposition of water or some other compound in aqueous solution. In other words, the batteries here considered are the Smee, the Daniell, the Grove and the various forms in which chromic acid is the oxygen-supplying substance.

This being premised we can begin with the following general statement of principles:—First. The source of energy being the reaction between the metallic zinc and the dilute acid, its amount can be expressed in British thermal units as follows:—Oxidation of zinc, 2340 B. T. U.; solution of oxide in dilute sulphuric acid, 666 B. T. U.; or, in all, 3006 B. T. U. as the total energy developed by the union of the zinc and acid. No arrangement of parts or employment of one material or another in other parts of the cell or for other parts of the reaction can add anything to this, but on the other hand there must always be more or less subtracted from it to meet the demands of the reaction, to say nothing of internal resistance of the solutions, local action, etc.

Second. In order that the zinc should combine with the acid, the hydrogen, whose place it takes, must be driven out or otherwise taken care of, and this will demand an expenditure of energy, greater or less, but always considerable. For example, in the Smee battery the hydrogen is simply driven out in bubbles of gas. To do this requires 2106 B. T. U. for each pound of zinc dissolved. Taking this from 3006, leaves only 900 B. T. U. as even possibly available from each pound of zinc consumed in a Smee battery, not counting losses coming from local action, resistance, etc.

This difficulty was realized at an early period and was met by supplying oxygen to take up the hydrogen, and so avoid the great loss involved in expelling it. To supply this oxygen various substances have been used, but the only ones of practical importance are sulphate of copper, nitric acid and chromic acid. But even with these, more or less energy must be expended in decomposing them and securing their oxygen. The energies involved are:

	B T. U.
Sulphate of copper, Daniell battery	1,587
Nitric acid, Grove or Bunsen battery	283.6
Chromic acid, Poggendorff battery	178.5

If these various amounts are subtracted from the maximum thermal value of the zinc-in-sulphuric-acid combination, we will have for the several batteries:—

	B. T. U.
Smee battery, as before	900
Daniell battery	1,419
Grove or Bunsen battery	2,722.4
Poggendorff (chromic acid)	2,827.5

These figures represent the absolute maxima of energy which a pound of zinc could develop in these forms of battery, excluding all losses from resistance, etc. To get a practical view of these results, however, it will be necessary to reduce them to equivalent foot-pounds of work and to horse-power rates of doing work.

Joule has shown that each British thermal unit is equal to 772 foot-pounds, and this means that the energy expressed by the heat which will raise one pound of water one degree Fahrenheit (this is the British thermal unit) would lift one pound 772 feet, or 772 pounds one foot. If, then, we multiply the figures given above, we shall have the various energies expressed in foot-pounds of work. In other words, a pound of zinc consumed in these various batteries would develop the following numbers of foot-pounds, all losses from resistance, etc., being excluded:—

	Foot-pounds.
Smee battery	694,800
Daniell battery	1,095,468
Grove battery	2,101,694
Poggendorff battery	2,182,820

If, in each of these batteries, one pound of zinc were consumed in a minute, then the above numbers of foot-pounds would represent the work developed in a minute in each case, and to turn this into horse-power we should divide each number by 33,000, because a horse-power is a rate of doing work of 33,000 foot-pounds each minute. This will give us the horse-power represented by the solution of one pound of zinc each minute in each battery.

Smee battery	21.05 H. P.	for one minute.
Daniell battery	33.19 "	" "
Grove battery	63.66 "	" "
Poggendorff battery	68.57 "	" "

Such a rate of consuming zinc as a pound a minute would, of course, require an immense galvanic battery, and indeed it is usual to express the consumption of fuels generally in pounds per hour. To get the horse-power due to the consumption of zinc at the rate of a pound an hour, we divide the above figures by 60, and this gives the horse-power developed by a pound of zinc consumed during an hour as follows:—

Smee battery	0.35,	or about ⅓	H. P.
Daniell battery	0.55,	" ½	"
Grove battery	1.06,	" 1	"
Poggendorff battery	1.14,	" $1\frac{1}{7}$	"

This shows that in the best forms of battery an allowance of one horse-power for each pound of zinc consumed per hour would be a liberal one, if something is allowed, as it must be, for the resistance, local action, etc. It may, however, be asked—If such an improvement has been made as above shown from the Smee battery giving one-third to the Poggendorff yielding $1\frac{1}{7}$ horse-power, may we not expect further improvements as great in amount? To this I answer certainly not in this class of batteries. The entire energy of the reaction between the zinc and dilute acid is 3006 British thermal units. This would represent 2,320,632 foot-pounds or 70.62 horse-power for one minute, or 1.17, say 1⅙, horse-power for one hour, and this would be an absolute maximum which could never be reached, far less exceeded.

Of course, if we could use some other, and more efficient, reaction than that between zinc and sulphuric acid, some gain might be secured, but nothing of that sort has ever been accomplished, nor from what is known of the combining or thermal equivalents of the available elements, is much to be expected in that line. At all events, we may well accept this as a certain fact, that in any known form of galvanic battery the round figure of a pound of zinc per horse-power per hour is an outside figure for efficiency, and when anyone asserts that more than this has been secured, there is certainly some mistake or fraud.

* From *Cassier's Magazine* June 1895.

THE CHICAGO AND ST. LOUIS ELECTRIC RAILWAY—This enterprise is being revived. It is now announced that the company will place $9,000,000 worth of bonds on the market. It is further stated that these bonds will be bought in St. Louis, New York and Chicago. This is the road that was to have been ready for operation during the World's Fair.

PRODUCTS OF COMBUSTION OF THE ELECTRIC ARC.

M. N. Gréhant in *Comptes Rendus* states that among the gases liberated from carbons kept incandescent by the electric arc is carbonic oxide. His method of operating was as follows: Around a lamp, the carbons of which gave a powerful and constant light, was arranged a small wooden box, 43cm. long. 29cm. wide, 60cm. in height, and of a capacity of 75 litres. Two metal tubes were fixed on two opposite sides, one at 2cm., the other at 32cm. from the bottom of the box, which was almost completely closed by a lid traversed by the cylindrical body of the electric lamp. Three experiments were made. They consisted in causing a dog to breathe for half an hour the gases resulting from the combustion of the carbons combined with the exterior air drawn in by the respiratory movements through hydraulic valves. The inspiration took place in the box, the expiration outside. The arterial blood of the dog, taken in the carotid artery, was analyzed before and after each experiment. In the first, the dog was placed in the box after the lamp had been running half an hour. The analysis gave $\frac{1}{1400}$ as the proportion of carbonic oxide contained in the air breathed by the animal. In the second the dog was put in the box at the moment of lighting the arc. The proportion of carbonic oxide was then $\frac{1}{3000}$, the reduced quantity being due to the gas not having been able to accumulate in the box. The treatment of carbonic anhydride by barytes water contained in a tube placed between the electric arc and the exhaust valve gave $\frac{1}{57}$ for the proportion of this gas, or 53 times greater than that of the oxide of carbon. The third experiment, made under the same conditions with another dog, gave $\frac{1}{2500}$ as the proportion of carbonic oxide, and $\frac{1}{62}$ as that of carbonic anhydride. Mr. Gréhant thus concludes his article: "It is therefore certain that the carbons of the electric arc throw off carbonic oxide in small quantities. If the lamps are in rooms of small size, such as certain of those containing machines generating electricity, the liberation of the toxic gas in the close atmosphere may contribute to produce among the workers the serious maladies which have from time to time been reported. A thorough system of ventilation should consequently be established, which would carry away all the products of combustion."

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

PRELIMINARY PROGRAMME NIAGARA FALLS MEETING, JUNE 25 TO 28, 1895.

The general meeting of the Institute will be held at the Cataract House, Niagara Falls, N. Y., beginning on Tuesday, June 25, at 10 A. M., and continuing four days. The following papers will be presented:

1. "The Substitution of Electricity for Steam in Railway Practice," (Inaugural address), by the President, Dr. Louis Duncan, of Baltimore.
2. "Properties of Fuse Metals when Subjected to Short-Circuits," by Walter E. Harrington, of Camden, N. J.
3. "Location of Grounds in Armatures, Fields, etc.," by Clarence E. Gifford, of Jamestown, N. Y.
4. "Some Features of Alternating Current Systems," by Chas. P. Steinmetz, of Schenectady, N. Y.
5. "Theory of General Alternating Current Transformer," by Chas. P. Steinmetz, of Schenectady, N. Y.
6. "Compounding Dynamos by Armature Reaction," by Elihu Thomson, of Lynn, Mass.
7. "Existing Commercial Applications of Electrical Power from Niagara Falls," by W. L. R. Emmet, of Schenectady, N. Y.
8. "Alternating Current Curves," by Dr. C. E. Emery, of New York.
9. "Electric Power in Factories," by Prof. Francis B. Crocker, Messrs. Benedikt and Ormsbee, of New York.
10. "Some Observations on a Direct-Connected 300-Kilowatt Monocyclic Alternator," by Profs. Dugald C. Jackson and S. B. Fortenbaugh, of Madison, Wis.
11. "On Mechanical Models of the Electric Current," by Prof. Brown Ayres, of New Orleans, La.
12. "On the Cause of Death in Electric Shock," by Albert M. Bleile, M.D., of Columbus, O.
13. "Long-Distance Power Transmission at 10,000 Volts," (The Pomona Plant), by George Herbert Winslow, of Pittsburgh.
14. "Notes on the Reconstruction of a Small Central Station Plant," by Franklin Leonard Pope, of Gt. Barrington, Mass.
15. "On Rating the Performance of Electric Power Plants and Transmission of Varying Loads," by Prof. Wm. S. Aldrich, of Morgantown, W. Va.
16. "Work of the Westinghouse Electric and Manufacturing Co. for the Cataract Construction Co. of New York," by L. B. Stillwell, of Pittsburgh.

Among the objects of engineering interest which it is proposed to visit are the new works of the Niagara Falls Power Company; the Niagara Falls Park and River Railway on the Canadian side; the aluminum plant of the Pittsburgh Reduction Company; the plant of the Carborundum Company; the central station of the Niagara Falls and Buffalo Electric Light and Power Company.

The date of this meeting has been fixed with a view to accommodating all who may wish to visit the Falls during the most desirable season. Members are requested to invite their friends, either ladies or gentlemen. Should a sufficient number of favorable responses be received reduced railway rates may be secured. The hotel rate will be $3.00 per day and upwards according to room, at the Cataract House. Those who prefer will find the International convenient.

TRANSPORTATION.

The Convention rate of one and one-third fare for the trip has been granted by the Trunk Line Association, conditional upon an attendance of one hundred members and guests. This covers the Grand Trunk (in part), N. Y. C. & H. R. R., West Shore, N. Y. O. & W., Erie, D. L. & W., L. V. R. R., C. R. R., of N. J., P. & R., B. & O., C. & O., Pennsylvania and other minor lines. Similar concessions are expected from other lines, east, south and west, the above covering only the territory east of Niagara and north of Pittsburgh except New England.

1. Buy an ordinary ticket and secure from ticket agent a certificate of purchase. Ample time should be allowed for this purpose.
2. This certificate, endorsed at the meeting, will secure a rebate of two-thirds fare returning over the going route, without stop over.
3. Tickets can only be bought three days before meeting, and the return tickets within three days from close. No tickets or certificates should be sold to scalpers.
4. If certificate is not to be had at small stations, local fare must be paid to nearest certificate point. Every member should secure certificate even if not to be used, as it will aid in securing the concession for others. No rebate will be allowed on fares of 75c. or less.
5. The rebate is dependent upon the attendance of 100 who have paid fare, otherwise no benefit is secured.

Wherever the number warrants, arrangements will be made for a special car. From New York City, the following trains and routes are suggested:

N. Y. Central, -	1 P. M., June 24, -	single fare	$9.25
West Shore, - -	6 " " 24, -	" "	8.00
Lehigh Valley, -	6 or 9 P. M. " 24, -	" "	8.00

Unless further advised members should make their own arrangements for berths, chairs and rooms.

Ayrton & Perry, of England, were the first to use the instrument now known as the ampere meter or ammeter. This was in 1879. They also introduced voltmeters at the same time.

LIGHTNING ARRESTERS AND WHY THEY SOMETIMES FAIL.*

BY ALEX. JAY WURTS.

The lightning arrester of today, as a protective device, differs from the lightning arrester of the early telegraph in detail only. A simple spark-gap, one terminal of which is connected to the line and the other to earth, is essentially the lightning arrester now in use. But, with the modern high-potential circuits, it is found that the dynamo current follows the static discharge across the spark-gap of the arrester, causing thereby a short circuit or dangerous ground on the line. In order to avoid this difficulty, arc-rupturing devices are attached to the lightning arrester, which have for their function the immediate interruption of the dynamo current, without interfering with the further operation of the lightning arrester as a discharging device. "Automatic Lightning Arresters," as they are called, differ among one another in the various means adopted for rupturing the dynamo arc. But the arc-rupturing attachment has nothing whatever to do with the apparatus as a lightning arrester, so that although automatic lightning arresters vary in outward appearance, and are in general more cumbersome and expensive than the original simple spark-gap arrester, yet, as lightning arresters, they are nothing more than spark-gaps. Various lightning-arrester attachments have been designed for the automatic rupture of dynamo arcs, put owing to the very high potentials which are so often used, they are found to be not only undesirable, but inefficient, the lightning arresters being frequently destroyed by the vicious dynamo arc.

In practice, however, complaints are not so much that lightning arresters are destroyed as that they "fail to protect." It is not unusual to see several different kinds of lightning arresters in a single station, which have evidently been installed with the idea of determining which one of them would prove the most efficient. But such experiments have met with disappointment, for the reason that sometimes one lightning arrester, and sometimes another, would receive the discharge, and the selective character of disruptive discharges was not understood. The failure of lightning arresters is not due to the particular *kind* of lightning arrester, or to the patent under which it is manufactured; it is due largely to the peculiar conditions with which it has to contend, namely, that the discharge is selective, and that, in order to protect apparatus, means must be taken to control these selections, or, at least, to provide so many paths to earth that the probable selection will be one of the many paths provided. In other words, lightning arresters do not "protect," they simply offer opportunities for discharge. These opportunities may or may not be embraced, according to circumstances. But the failure of lightning arresters is not altogether due to the peculiar conditions already referred to. Poor ground connection, inductive resistance in the grouud circuit, defective insulation in the apparatus to be protected, and a general misunderstanding of the subject, are not infrequently the cause of serious losses which might otherwise have been avoided.

We have noticed that lightning arresters do not "protect," that they simply offer opportunities for discharge. We have also noticed that discharges do not pass readily through coils of wire—coils therefore protect. Properly constructed choke coils, connected in the circuit, offer a high resistance to the passage of disruptive discharges, and when used in connection with lightning arresters the combination offers a very reliable means of protecting well-insulated apparatus against lightning. Laboratory experiments, together with tests made under actual working conditions, indicate the advisability of using four choke coils in series, in each wire, with four lightning arresters intervening. This arrangement is more particularly suitable for the protection of station apparatus. Coils can, however, be used to advantage on the line for the protection of the more expensive translating devices.

The general construction of a choke coil is a matter of considerable importance. A flat spiral possesses some advantages over the helix, but for practical purposes these hardly compensate for the lower cost of the latter, which, for best results, should be wound over a wooden or other non-conducting core. Metal cores and cases should be avoided, because the induced currents in these parts would lower the choking effect of the coils. The number of turns which can be used to advantage is limited. It is found by experiment that, with given conditions, the choking effect increases with the number of turns up to a well defined critical point, after which additional turns fail to have any appreciable effect. It is probable that these critical points vary with the amount of electricity discharged; that is, for heavy discharges the critical point for maximum choking effect would embrace a larger number of turns than would smaller discharges, and the choking effect for a given number of turns within a critical point would also be greater for heavy than for small discharges. For practical purposes the writer recommends from forty to fifty feet of wire wound either into a flat spiral having an internal diameter of three inches, or into a three-inch helix with a single layer.

The failure of lightning arresters is too often due to careless installation. It may be instructive to note several examples:

(1) One plant is reported as having, for better protection, connected two arresters in series. This was probably done with the idea that if a little was good more would be better.

(2) A large bank of station arresters was grounded to an iron bolt about two feet long, driven into dry sand.

(3) Line arresters were grounded by pushing the ground wires into the earth.

(4) Line arresters were grounded on iron poles, which were themselves set in Portland cement.

(5) An annual inspection of automatic lightning arresters developed the fact that the arresters were nearly all burned out—in other words, that the line was left unprotected.

(6) The ground plate of a bank of arresters was thrown into a neighboring stream, which subsequently changed its course, leaving the ground plate high and dry.

(7) The ground plate of a bank of station arresters was laid on the rock bottom of a neighboring stream.

(8) In a large number of cases a portion of the ground wire is wound into a fancy coil (choke coil). And the list might be indefinitely extended, each such case forming a source of complaint that the arresters "fail to protect." But when these curious mistakes are located and properly remedied the complaints cease.

* Abstract from lecture before the Franklin Institute, Philadelphia, March 15, 1895.

D. F. LEWIS TO RESIGN.

It is reported that Daniel F. Lewis, president of the Brooklyn Heights Railroad, will soon be retired and that he will be succeeded by E. G. Russell, superintendent of the Rome, Watertown and Ogdensburg Railroad.

Mr. Lewis said in reply to an inquiry that he had not handed in his resignation, but that he stood ready to do anything to forward the reorganization plans which are under way, provided they did not impair the credit of the company. Ex-Gov. Flower and some capitalists who are cooperating with him have now, it is said, secured a controlling interest in the Long Island Traction Company, which is the lessee of the Heights road.

—Aluminum wire is increasing in use, and if it continues to cheapen may be the wire of the future. Its electrical conductivity is three times that of iron, and more than half as great as copper, while its tensile strength is one-third that of steel, and its resistance to corrosion phenomenal.

THEORY OF LIGHT.

BY NEWTON HARRISON.

The opinions of Sir Isaac Newton relative to the nature of light, though totally disregarded today, still might be looked upon with some consideration in the light of our present knowledge.

His theory that the emission of infinitely small particles from any light-giving body affected the eye and gave the sensation of light was defective only in so far as it called for a collision between the sensory nerves of the eye and this self-same impalpable dust. At that time no medium of the nature of ether could have been well comprehended, either as regards its existence or function, so that the philosophy of the times called for its nearest equivalent.

There is a blow given to the eye every time an ether wave or light affects it, and in this respect the weightless matter of Newton and the ether of Clerk Maxwell do not differ to such a remarkable degree.

Although it might not be considered relevant to the subject to discuss self-induction in a circuit, yet the proper development of that department of design touching upon the internal troubles in armatures can not be understood unless the true meaning of the phenomenon be appreciated. Its tendency to oppose the flow when the circuit is closed and assist the flow when the circuit is opened are its most familiar features. Allied to it in direction of flow is the so-called mutual induction between two circuits. The incidental difference between the two is due to the fact that, the change occurs in one case in the same circuit and in the other case in a separate circuit. The cause which brings into existence this foreign E. M. F. in the circuit is due altogether to the change in the position of the lines of force around it.

A circuit moved in the neighborhood of lines of force, or a circuit having lines of force moved in its vicinity, must experience some electrical change of an expected and calculable character. This is brought about by the gradual *growth* of current in any circuit or the departure. In either case the non-uniformity of strength at the start or at the leaving is naturally accompanied by a decrease or increase of lines of force, as the case may be. The conductor itself, the very cause of the changes, becomes the seat of a new E. M. F.—a counter E. M. F. in one and an assistance in the other case.

In a case of mutual induction the lines of force act upon another circuit, in which is induced those changes, which otherwise only the movement of the conductor in a magnetic field could produce.

The general statement that can be made concerning the development of this E M. F. is that it is proportional to the square of the turns.

The symbol by which it is represented is L, then the formula for calculating it in absolute measure is—

$$L = \frac{4 \pi n^2 c \mu q}{10 l}$$

in which n = turns in coil
c = current in amperes
μ = permeability
q = cross section
l = length of magnetic circuit
L = coefficient of self-induction.

The above quantity has been defined by name as the "Henry" and is called the unit of self-induction with a certain strength of current, permeability, etc.

COST OF POWER AT NIAGARA.

Much has been said about the cost of power at Niagara, and what is printed regarding the subject is always read with interest.

The following article appeared in the New York *Tribune* of recent date, and as it contains pertinent facts we reproduce it for the benefit of our readers:

"The company which has undertaken to develop electricity at Niagara, on a large scale, for manufacturing and other purposes, has acquired more real estate there than it needs for its own use, in order to furnish sites to such of its customers as wish to establish their business close to the source of their mechanical power supply. But the public has been led to expect that in addition to serving local interests, the company would also furnish electricity to places scores, if not hundreds, of miles away, and there has been much speculation as to the feasibility of carrying such plans into effect. Owing to her proximity to the Falls and her great size and industrial activity, Buffalo has been regarded as the first centre of population, removed from Niagara, to be provided for. It is not yet quite clear whether that city feels that it is enjoying a privilege or conferring a favor in letting the Power Company invade its precincts. Perhaps she has not determined that point herself. The matter is evidently still under consideration. In reply to some inquiries from representative Buffalonians, the Power Company recently offered the following terms: It would let the municipality or a private corporation come to Niagara, take water from the Power Company's canals at the rate of $10 a horse-power, and manufacture its own electricity; or it would furnish power off the turbine shafts at $13, or electricity at the power-house at $18. But if the Power Company undertook to do anything of this sort, it would not contract to deliver less than 10,000 horse-power; hence, Buffalo must agree to take at least that much or none at all. The Niagara people would not accept a franchise to operate a line to and in Buffalo for a shorter time than that for which its own bonds have been issued. No price is given for electricity delivered at a central station in the suburbs of that city, fifteen miles from the Falls, so that the company's own estimate of the probable waste and cost of transmission is still withheld. There would be four kinds of losses: (1) In transforming at the power-house up to a high voltage, (2) on the line, (3) in transforming down at Buffalo, and (4) in distribution over street lines to consumers. These could not well amount to less than twenty or thirty per cent. altogether, and they might, perhaps, reach fifty or sixty per cent. But if, for example, they amounted to just one-half, the $18 rate at the generator shaft would mean $36 to the consumer, without adding anything either for interest on the cost of the transmission plant or for operating expenses. This, however, is probably an extravagant estimate. The prices actually given, by the way, are for a twenty-four hour daily supply. Some establishments require power, however, for only ten or eleven hours. Whether it would pay to put in storage batteries to utilize the surplus is a question which their managers must naturally consider. Richard Hammond writes to the *Buffalo Courier* to say that steam-power, on a scale of 1,000 horse-power for ten hours daily, can be generated in Buffalo, where coal is very cheap, for $21 per horse-power. The Power Company, however, denies this, and estimates the cost at $32, besides quoting various experts as estimating the cost on a twenty-four hour basis at between $45 and $60. In some other cities, where coal is more expensive, it is said to be from $60 to $75. If, after this discussion, Buffalo decided neither to buy on the terms offered, nor to let the Power Company bring in its own lines and supply the market, more distant cities may possibly be deterred by her example from patronizing the Niagara concern; but as the latter supplies its local customers with electricity at $20 per horse-power, in large quantities, there may be a greater industrial development at the Falls than would otherwise result."

RAPID TRANSIT PLANS.

At the meeting of the Rapid Transit Commissioners held on June 4, Chief Engineer W. B. Parsons submitted a report regarding the general manner of operating the proposed routes, their equipment, and the location of the stations. Mr. Parson says:

"Electricity undoubtedly offers the greatest advantages as a source of power. It should be generated at a central

station, located so as to obtain coal conveniently and conveyed to the motors of the trains by solid conductors. As the railway proposed will be both in tunnel and on viaduct, these conductors will probably be placed between the rails. It is at present neither necessary nor advisable to use separate electric locomotives, but to place motors under one of the regular cars and to have such car at the head of a train acting as a motor car."

As to the general method of operation Mr. Parsons says that for the local tracks the things to be desired are frequency of service and speed. He would have trains made up of two cars, or at most of three, and these should move at intervals of about one-half a minute. In this way only short stops would have to be made at stations, and no accumulation of passengers could occur. The local stations would be close together. For express service, on the two tracks to be reserved for that purpose, the trains would have to be heavier—made up of five or six cars—and the stations should not be nearer together than one and a half miles. He recommends the following locations for stations:

Main route from the Battery up Broadway and the Boulevard to 185th street. Local stations—South Ferry, Bowling Green, Wall street, Liberty street, Fulton street, Warren street, Worth street, Walker street, Grand street, Prince street, Great Jones street, Clinton place, Fourteenth street, Eighteenth street, Twenty-seventh street, Thirtieth street, Thirty-fourth street, Thirty-eighth street, Forty-seventh street, Fifty-third street, Sixty-fifth street, Seventy-ninth street, Eighty-sixth street, Ninety-first street, Ninety-sixth street, 103d street, 116th street, 122d street, 133d street, 140th street, 147th street, 155th street, 162d street, 169th street, 175th street, 181st street, and 185th street.

Express stations on this same route would be at South Ferry, Fourteenth street, Forty-second street, Seventy-second street, 110th street, and Manhattan street.

On the east side route, which branches off at Fourteenth street and runs up Fourth and Park avenues and across the Harlem to Walton avenue and 146th street, the local stations would be at Twenty-third street, Twenty-eighth street, Thirty-third street, Thirty-seventh street, Fiftieth street, Fifty-seventh street, Sixty-fifth street, Seventy-second street, Seventy-ninth street, Eighty-sixth street, Ninety-seventh street, 106th street, 116th street, 125th street, 134th street, 138th street, and 146th street.

There would be only one express station above Fourteenth street on this route, and that would be at Forty-second street. On the City Hall loop there would be an express and local station at the Brooklyn Bridge, where trains could be taken for either route.

The Commissioners ordered the report printed and laid over for further consideration.

The Commission hopes to be ready soon to apply for the court's consent in lieu of that of the property owners along the routes. It has become known that a majority of the property owners along the routes have refused their consents. This announcement will be put in legal form by the end of the week.

MARRIED.

Mr. Stephen L. Coles, associate editor of the *Electrical Review*, of this city, was married to Miss Sallie E. Field, on June 1. The Electrical Age extends its sincere congratulations to Mr. and Mrs. Cole and wishes them a long life of happiness.

Mr. Fred H. Hayward, of the Western Engine Co., was married to Miss Jane Day, at the residence of her father, Mr. Jared Day, 158 W. 74th street, New York, on June 5th. We extend to Mr. and Mrs. Hayward our congratulations.

Personal.—Mr. H. T. Paiste, of Philadelphia, will on June 15 sail for Europe, for business and pleasure.

THE TROLLEY'S WORK.

"A strong, healthy man like you ought not to be out of work."

"I'm willin' to work, ma'am, but I can't get nothin' to do at my trade. Raw material's all gone."

"What's your trade?"

"Blacksmith."

"Surely there's plenty of iron."

"Yes'm, but I'm a horseshoer. There ain't no horses."
—*Chicago Tribune.*

The trolley doesn't do all of the killing in Brooklyn. Occasionally a victim is fendered to death.—*Washington Post.*

The Kind of Fender Needed.—"What is really needed in the way of a fender is one that will allow of identifying the victim," says the Boston *Journal.*

THE ELECTRICAL AND MECHANICAL ENGINEERING COMPANY INSOLVENT.

The Electrical and Mechanical Engineering Company, of 41 Cortlandt street, New York, has become insolvent, and Judge Andrews of the Supreme Court appointed Jonathan H. Vail on June 5 as receiver for the concern on the application of the directors. The company was incorporated two years ago with a capital stock of $150,000. The liabilities are $26,441, and the nominal assets $22,000. The most important of the assets is a contract with the trustees of the New York and Brooklyn Bridge for electric lighting of the cars, which is put down at $19,419. The claims of three creditors, the Third National Bank, $5,150, General Electric Company, $5,289, and Wallace & Sons, $913, have been secured by the above contract.

ZIMDARS & HUNT.

Messrs. Zimdars & Hunt, electrical engineers and contractors, No. 127 Fifth avenue, New York, have fitted out with a complete electric light plant the steam yacht "Sultana," owned by J. W. Drexel, of Philadelphia. They have also refitted the steam yacht "Sagamore," owned by Edgar Scott, of Philadelphia, with a complete plant. Both plants have a capacity of 160 lamps. The new Crompton dynamo and fixtures were installed in each. A 20,000-c. p. search lamp, made by Renier, of Paris, is also installed on each vessel.

They have also fitted out Commodore Brown's steam yacht "Sylvia" with 60 lamps, a Lundell dynamo direct-connected with a Sturtevant engine, new fixtures, etc. All of this work has been done this spring.

The firm is now installing 1,000 lamps in the new public school, 117th street and Edgecombe avenue, New York, and 1,200 lamps in the new school building, 140th street, New York. A Western Electric dynamo direct-connected to Ball & Wood engines is installed in the latter plant, and a General Electric dynamo in the 117th street building.

They have just completed the installation of a plant in the Female High School, Baltimore, Md.

Telephone Notes.

A company in Daytona, Fla., is after a telephone franchise in that place. It proposes to run wires from there to Silver Beach, Halifax, and Sea Breeze.

Quincy, Fla., is to have a telephone exchange. The Florida Telephone & Construction Company has the matter in hand.

An exchange will be installed in Gainesville, Ga., and wires probably extended to Jefferson.

The Chesapeake and Potomac Telephone Company, Baltimore, has received permission to erect and maintain lines in Annapolis for 10 years.

E. C. Hein, of Ridgeway, S. C., will construct a telephone system in Statesville, N. C.

The Burlington Electric Light and Street Railway Company, Burlington, Iowa, E. C. Walsh, president, is receiving bids for telephone instruments for the new Burlington Exchange and for the long line to Columbus Junction.

TELEPHONE PATENTS ISSUED JUNE 4, 1895.

Telephone System.—William W. Dean, St. Louis, Mo. (No. 540,239.)

New York Notes.

Office of the Electrical Age,
World Building, New York,
June 10, 1895.

Mr. Harry M. Shaw, 126 Liberty street, has secured the sole agency for New York and vicinity for H. T. Paiste switches, sockets, cut-outs, etc. He is very bust just now filling orders for Universal non-arcing lightning arresters. He reports, also, that he is doing an excellent business with Eureka tempered copper goods. Not a day passes but what he gets at least one order for Eureka products.

John S. Parker, who was connected with the late Electric Construction and Supply Co., and afterwards with R. B. Corey in the lamp business, has accepted a position with Mr. Chas. A. Bramhall, 39 Cortlandt street, Room 93. Mr. Bramhall is sales agent for the arc lamp department of the Standard Thermometer Co. W. T. H.

New Corporations.

Marietta Electric Co., Marietta, Ga., by D. N. Anderson, G. F. Gober, A. S. Clay and others. Capital stock, $10,000.

The Blue Earth Valley Telephone Exchange Company, Blue Earth, Minn., by Washington Z Haight, Andrew C. Dunn, and others. Capital stock, $50,000.

The Springer Electric Company, McCordsville, Hancock, County, Ind., by T. L. Springer, S. Morrison and A. C. Morrison, for the purpose of manufacturing electrical apparatus and operating telephone exchanges.

The Geauga County Telephone and Electric Company, Huntsburg Centre, Geauga County, Ohio, by George W. Pease, and others, to build and operate a telephone line from Huntsburg Centre to Chardon. Capital stock, $2,000.

Street Railway Notes.

An electric railroad will probably be built in Gainesville, Ga., and suburbs. D. E. Evans is interested in the project.

There is talk of building an electric road from Princess Anne to Deal Island, Md. The distance is 10 miles. T. H. Bock, of Princess Anne, is interested in the project.

The New York Board of Aldermen on June 4 decided to grant to the Third Avenue Railroad Company the city's consent to the building and operating of a cable road on what is known as the Kingsbridge route, on the upper west side of the city. The franchise is yet to be sold at auction to the highest bidder.

The Gwynn's Falls Electric Co., Baltimore, Md., will introduce the trolley system on its lines.

At the meeting of the State Railroad Commission in Albany, N. Y., June 4, permission was given to the Southern Boulevard Railway Company of New York City, a part of the "Huckleberry" road's system, to use the trolley on its line from Third avenue to the Boston Post road. An application of the Niagara and Lewiston road for the authority to increase its capital stock from $100,000 to $1,400,000 was granted. The company will build an electric line along the banks of the Niagara River from Niagara Falls to Lewiston.

Possible Contracts.

Address G. G. Lake, Gainesville, Ga., for particulars regarding telephone exchange in that place.

F. G. Goodwin, Reynolds, Ga., is interested in the project to establish an electric light plant in that place.

An electric light plant is to be constructed in Kuttawa, Ky.

There is talk of establishing an electric light plant in Lexington, Ky. The mayor can give further information.

Ferguson, Mo., will probably install an electric light plant to cost $10,000. Address the mayor for further particulars.

Pulaski, Tenn., wants an electric light plant, and is talking about the matter.

John P. Jones, Terra Alta, W. Va., proposes to build a three-story hotel, to be lighted by electricity.

The Mayor of Westport, Mo., can give information concerning a proposed electric light plant in that place.

An electric light plant will probably be established in Alfred, N. Y.

The Franklin Falls Company, Franklin Falls, N. H., will erect a new power house.

The Laurel, Md., electric light plant has been purchased by a local company, of which Dr. De W. Snowden is president. The new company goes under the name of the Electric Company of Prince George's County.

Trade Notes.

The Sulzer-Vogt Machine Co., Louisville, Ky., has just issued an illustrated catalogue of its electric elevators for passenger and freight service.

The Emerson Electric Mfg. Co., of St. Louis, Mo., has just issued a handsome catalogue of the well-known Weston alternating current motors. Improvements have been made in this machine and the company now believes that its 1895 models are practically perfect machines.

Mr. W. C. McKinlock, the genial secretary of the Metropolitan Electric Company, Chicago, has just returned from a southern trip. He has secured some profitable orders and reports a decided improvement in business.

The Metropolitan Electric Company, 186–188 Fifth avenue, Chicago, has secured an order for their Portable Fire Hose Bridge from the Chicago Transit Company who, recognizing the merits of this device, have decided to equip their lines with these bridges. The Metropolitan Electric Company also report a good demand for their various first-class specialties, such as P. & B. Products, Solar Arc Lamps, N. I. R. Wire, Dayton Ceiling Fans, Keystone Instruments, etc.

HATZEL & BUEHLER.

Messrs. Hatzel & Buehler, electric engineers and contractors, 114 Fifth avenue, New York city, are completing the installation of the American Surety Building, corner Broadway and Pine street. This building, which is 22 stories high, when completed will be lighted by 5,500-c. p. lamps. There will be 200 fifty c.-p. lamps around the eaves of the square roof. This firm furnished the wire and did the wiring. Habirshaw wire is used for all the lamps. The marble switchboard is 8 x 34 feet in size and equipped with Weston instruments. The building is also wired for telephones, telegraph, watchman's clocks, fire alarms, etc. The current for the lighting is generated by Siemens and Halske dynamos, run by Ideal engines.

Hatzel & Buehler are also wiring Grace Church Chapel, New York. This plant includes two 50-K. W. and one 25-K. W. Mather dynamos, and three Armington & Sims engines, furnished by E. P. Hampson & Co. 36 Cortlandt street. A motor will be employed to operate the organ.

Among other plants being installed by this firm are the following: Mohawk Building, one 50 and one 25-kilowatt General Electric dynamos, run by Straight-Line engines; wiring lamps, switchboard, etc.; two 25 K. W. General Electric dynamos, two Straight-Line engines, and 40-H. P. of motors for ventilating in the House of Relief, Hudson avenue and Jay street, New York; wiring of the house of Commissioner Hoven, 24 East 39th street, New York, and the wiring of the new Grace M. E. Church, 104th street, near 9th avenue, New York. They are now completing the electric installation of George Vanderbilt's chateau at Biltmore, N. C.

They are also installing a 3,500 lamp plant in the New Hoffman House, 25th street and Broadway, New York.

Hatzel & Buehler are always very busy; they keep 150 men constantly at work.

KIND WORDS FROM FRIENDS.

"For enclosed check please send your journal to...... ....Concepcion, Chile. I am in hopes that my above-named Chilian friend will in course of time send me good orders for American manufacturers of electrical goods."

M. G.

New York, May 16.

"I cheerfully renew my subscription to The Electrical Age. I derive more benefit from it than from any other electrical paper, and do not hesitate to acknowledge the fact. In my opinion The Electrical Age is the best of the electrical papers."

S. S. G.

Brooklyn, N. Y.

The Electrical Age is much read in Japan, especially in Tokio, where are many electricians. I expect to get you some more subscriptions.

S. K.

Tokio, Japan.

"It gives me pleasure to note the good progress you are making with your journal. You'll be at the top of the heap, first thing you know."

Yours, with best wishes,

R. G. K.

Cleveland, Ohio.

WOVEN WIRE BRUSHES.

The Belknap Motor Co., of Portland, Maine, are the patentees and manufacturers of the best woven wire commutator brush on the market.

National Electric Light and Street Railway Associations.

NATIONAL ELECTRIC LIGHT ASSOCIATION.

President, C. H. Wilmerding, Chicago, Ill.; 1st Vice-President, Frederic Nicholls, Toronto, Canada; 2d Vice-President, E. F. Peck, Brooklyn, N. Y.

Members of Executive Committee: E. H. Davis, Williamsport, Pa., (one year); W. R. Gardiner, Pittsfield, Mass.; George A. Redman, Rochester, N. Y.; J. J. Burleigh, Camden, N. J. Next meeting, New York, May or June, 1896.

AMERICAN STREET RAILWAY ASSOCIATION.

Next meeting, Montreal, Que., October, 16, 17 and 18, 1895.

President, Joel Hurt, Atlanta, Ga.; Vice-President, W. Worth Bean, St., Joseph, Mich.; 2d Vice-President, John M. Cunningham, Boston, Mass.; 3d Vice-President, Russell B. Harrison, Terre Haute, Ind., Secretary and Treasurer, William J. Richardson, Brooklyn, N. Y.; Executive Committee, Henry C. Payne, Milwaukee, Wis.; W. H. Jackson, Nashville, Tenn.; D. G. Hamilton, St. Louis, Mo., C. C. Cunningham, Montreal, Canada; J. N. Partridge, Brooklyn, N. Y.

NEW YORK STATE STREET RAILWAY ASSOCIATION.

Next meeting, Albany, N. Y., third Tuesday in September. 1895.

President, G. Tracy Rogers, Binghamton; First Vice-President, John H. Moffitt, Syracuse; Second Vice-President, W. W. Cole, Elmira; Secretary and Treasurer, William J. Richardson; Brooklyn; Executive Committee, D. B. Hasbrouck, New York; John N. Beckley, Rochester; Daniel F. Lewis, Brooklyn.

OHIO STATE TRAMWAY ASSOCIATION.

Next meeting, fourth Wednesday in September, 1895.

President, Albion E. Lang, Toledo; Vice-President, W. J. Kelly, Columbus; Secretary and Treasurer, J. B. Hanna, Cleveland; Chairman Executive Committee, W. A. Lynch, Canton.

MASSACHUSETTS STATE STREET RAILWAY ASSOCIATION.

President, T. H. Cunningham, Boston; Secretary and Treasurer, A. S. Butler, Lawrence; Executive Committee, Samuel Winslow, Alfred A. Glazier, Boston; P. F. Sullivan, Lowell; E. C. Foster, Revere; Horace B. Rogers, Brockton; A. E. Smith, Springfield; Prentiss Cummings, Boston.

THE TEXAS STREET RAILWAY ASSOCIATION.

President, W. H. Sinclair, Galveston; vice-president, C. A. McKinney, Houston; Secretary and Treasurer, C. L. Wakefield, Dallas. Directory: The officers and W. H. Weiss, San Antonio and George B. Hendricks, Fort Worth.

Next meeting, Galveston, third Wednesday in March, 1896.

PENNSYLVANIA STATE STREET RAILWAY ASSOCIATION.

Next meeting, first Wednesday in September, 1895.

President, John A. Rigg, Reading; First Vice-President, Robert E. Wright; Secretary, S. P. Light, Lebanon; Treasurer, W. H. Lanius, York.

THE MAINE STREET RAILWAY ASSOCIATION.

President, W. R. Wood, Portland; Secretary and Treasurer, E. A. Newman, Portland; Executive Committee, W. R. Wood, Portland; George E. Macomber, Augusta; F. M. Laughton, Bangor; Frank W. Dana, Lewiston; Amos F. Gerald, Fairfield.

MICHIGAN STATE STREET RAILWAY ASSOCIATION.

President, W. L. Jenks, Port Huron; Vice-President, W. Worth Bean, St. Joseph; Secretary and Treasurer, B. S. Hanchett, Jr., Grand Rapids; Executive Committee, the Officers and David H. Jerome, Saginaw, and Strathern Hendrie, Detroit.

THE STREET RAILWAY ASSOCIATION OF THE STATE OF NEW JERSEY.

President, Thos. C. Barr, Newark, Vice-President, W. S. Scull, Camden; Secretary and Treasurer, Charles Y. Bamford, Trenton; Executive Committee, Officers and C. B. Thurston, Jersey City; H. Romaine, Paterson S. B. Dod, Hoboken.

ELECTRICAL and STREET RAILWAY PATENTS

Issued June 4, 1895.

540,239. Telephone System. William W. Dean, St. Louis, Mo., assignor to the Bell Telephone Company of Missouri, same place. Filed Feb. 21, 1895.

540,244. Electric Heater. Edward E. Gold, New York, N. Y. Filed Jan. 29, 1895.

540,305. Closed-Conduit Electric Railway. Michael F. Flynn, Stamford, Conn. Filed July 28, 1894.

540,323. Electromagnetic Winding. Osborn P. Loomis, Bound Brook, N. J., and Charles A. Pierce, Lynn, Mass. Filed Mar. 9, 1895.

540,325. Electric Trolley for Canal-Boats. Alonzo C. Mather, Chicago, Ill. Filed Dec. 1, 1893. Renewed May 3, 1895.

540,333. Electric-Arc Lamp and Carbon. Charles A. Pfluger, Chicago, Ill., assignor to the Standard Electric Company, same place. Filed Oct. 13, 1894.

540,340. Trolley-Pole With Locking Wheels. Thomas Thompson, Newark, N. J. Filed Oct. 29, 1894.

540,341. Electric Burglar-Alarm. James Tomney, New York, N. Y. Filed May 2, 1892.

540,351. Dynamo-Electric Machine. George De Camp, St. Louis, Mo., assignor to the Atwood Electric Company, same place. Filed Sept. 24, 1894.

540,358. Electric Switch. John O. Heinze, Jr., Lynn, Mass. Filed Dec. 4, 1894.

540,379. Car-Fender. John B. Benton, Elizabeth, N. J. Filed Apr. 11, 1895.

540,398. Electric Heater. John E. Meek, Denver, Colo., assignor to the H. W. Johns Manufacturing Company, New York, N. Y. Filed Feb. 5, 1894.

540,404. Electric-Arc Lamp. Henry Radcliffe, Milwaukee, Wis., assignor of three-fourths to Thomas K. Creighton and John C. Sundin, same place. Filed Mar. 19, 1895.

540,456. Electric Motor. Frederick Pearce, New York, N. Y. Filed Dec. 3, 1890.

540,463. Electric Gas-Lighter. George W. Shepherd, Philadelphia, Pa. Filed Mar. 13, 1895.

540,466. Switch for Street-Railways. Richard S. Tappenden, Cleveland, Ohio, assignor of one-half to Thos. Tappenden, same place. Filed Aug. 3, 1894.

540,477. Telegraphy. Cyprien R. J. Willot, Paris, France, Filed Apr. 24, 1894. Patented in France Aug. 13, 1892. No. 223,657, and in England Dec. 17, 1892, No. 15,689.

540,480. Apparatus for Use With Electrically-Illuminated Signs or Advertisements. Ernst L. Berry and Frederick Harrison, London, England. Filed Nov. 21, 1894.

540,485. Pick-Up Car-Fender. Edwin D. Crouch, Washington, D. C. Filed Mar. 28, 1895.

540,486. Trolley for Electric Railways. Theophile Euphrat, Darien, Conn. Filed Mar, 5, 1895.

540,487. Ice-Detaching Trolley for Electric Railways. Theophile Euphrat, Darien, Conn. Filed Mar. 22, 1895.

540,529. Electrically-Controlled Speaking-Tube. George S. Williamson, McKeesport, Pa. Filed Feb. 18, 1895.

540,540. Underground Electrical Conductor and Method of Manufacturing Same. John H. Croskey and Joseph Locke, Pittsburgh, Pa. Filed Jan. 17, 1895.

540,557. Electric Regulator. James McKim, Weir, Kan. Filed Sept. 12, 1892.

540,569. Conduit Electric-Railway System. Charles M. Allen, San Francisco, Cal. Filed Oct. 3, 1894.

540,608. Apparatus for Electrically Purifying Water. George M. Collier and Richard T. Detlefs, Cleveland, Ohio. Filed Nov. 10, 1894.

REISSUES.

11,498. Electrical Signaling System. Bradley A. Fiske, U. S. Navy. Filed Feb. 16, 1895. Original No. 527,958, dated Oct. 25, 1894.

ELECTRICAL AGE

VOL. XV., No. 25. NEW YORK, JUNE 22, 1895. WHOLE No. 423

ESTABLISHED 1883.

Entered at New York P. O. as second-class matter, January 18, 1891.

THE ELECTRICAL AGE PUBLISHING CO., PUBLISHER

TERMS OF SUBSCRIPTION:
One Copy, one year, - - - $3.00
One Copy, six months, - - - 1.50
Great Britain and other Countries, - - 4.00

Cable Address (all Cables,) "Electage," New York.

W. T. HUNT, President F. N. BASSETT, Vice-President.

T. R. TALTAVALL, Secretary and Editor.

NEWTON HARRISON, E. E., Scientific Editor.

Canadian Representative, E. W. SAYER, Montreal, Que.

ADDRESS ALL COMMUNICATIONS TO

THE ELECTRICAL AGE PUBLISHING COMPANY,

FIRST FLOOR, WORLD BUILDING.

NEW YORK.

NEW YORK, JUNE 22, 1895.

CONTENTS.

THE BERLINER CASE.

The text of the decision of the United States Circuit Court of Appeals in the Berliner transmitter case was made public on Monday, June 17. The substance of the decision was given out on May 18, last. As is already well known, it reverses the decision of the Circuit Court for the District of Massachusetts in favor of the government and against the Bell Telephone Company. The decision of the Court of Appeals is a lengthy one, and owing to the crowded condition of our columns this week we are unable to give more than the bare announcement. The decision concludes with the following language: The United States has filed a motion in this court, praying that if we find for the appellants, we will reserve leave to the Circuit Court to permit an amendment at bar, alleging that the American Bell Telephone Company did directly agree with the representatives of the Drawbaugh application that the determination by the Patent Office of the question of priority should abide the decision in The Telephone Cases, that these parties, acting in concert, did procure the Commissioner of Patents to consent to such postponement, and that thus the American Bell Telephone Company, by its own act, procured the postponement of the decision of priority, without necessity or right, in violation of its duty to speed the patent for the microphone. We have already found that, as the record now stands, it contains no proof to sustain an allegation of this character. Therefore, an amendment of this nature would require the opening of the record below for further proofs. It is not at all a case where a complainant has proved his case, but his allegations are found by the appellate court to be inapt. To grant this motion would under the circumstances violate all the rules requiring diligence from parties complainant. The decree of the Circuit Court is reversed, and the case remanded to that court with directions to dismiss the bill.

WHAT IS THE MATTER?

Although this is the age in which words are not bandied concerning facts which are beyond our range of observation, there is still a certain fascination in examining the various hypotheses afloat concerning the real nature of matter.

Are the elements decomposable? It would fill a chemist with supreme delight to be able to prove this hypothesis.

All the resources of the laboratory have been brought forward with the object of decomposing oxygen, iron or any other unresolvable substance into some other possible constituents. It is unnecessary to state that all have failed, yet there are many curious instances that tend to lead us to an opinion in the affirmative. When copper is refined by electrolysis the black mud or sludge that falls to the bottom contains about three dollars' worth of gold to the ton. Silver is also present and traces of other less valuable metals. There is no doubt that the characteristic properties of each metal individualizes it; its appearance and nature makes it markedly different from another.

Yet the fact that the close association of these metals is not unusual may have some bearing upon future conclusions regarding them. Certain very high temperatures and pressures may have caused the present differences between the metals; perhaps there always was and always will be these differences.

If it were possible to artificially reproduce the conditions that existed in the early history of this earth, there is no doubt that the strangest results would be obtained by exposing elements of a volatile nature to such terrific heat and pressure.

THIS IS A VALUABLE ISSUE.

By reason of its customary enterprise THE ELECTRICAL AGE this week presents to its readers a vast amount of new, interesting and valuable matter. At the convention of the Association of Railway Telegraph Superintendents held in Montreal last week many valuable papers were read and discussed. Some of these papers, entire or in part, appear in this issue and the balance will be printed in subsequent editions. The enterprise of THE ELECTRICAL AGE in this matter stands out in strong relief against the lethargy of the oldest electrical papers published.

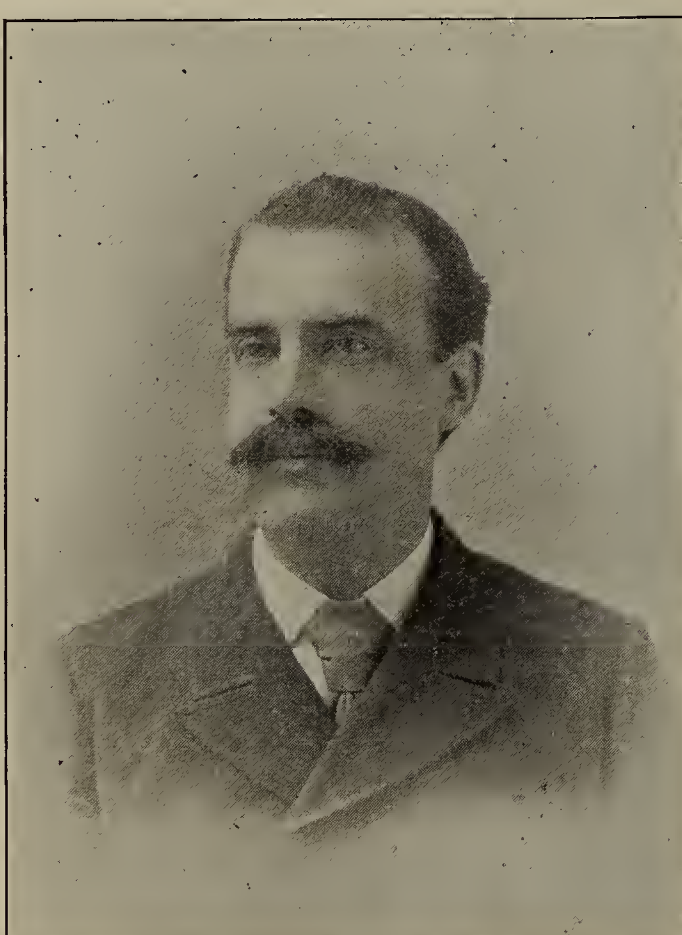
CONVENTION OF RAILWAY TELEGRAPH SUPERINTENDENTS.

The 14th annual meeting of the Association of Railway Telegraph Superintendents was called to order at the Windsor Hotel, Montreal, Que., at 10.30 A. M., June 12. In the absence of President Greene, Vice-President M. B. Leonard occupied the chair.

After the committee of arrangements had read its report the following-named new members were elected: A. J. Hollenbeck, Chicago and Great Western, St. Paul, Minn.; J. H. Louy, Cincinnati, Hamilton & Dayton, Lima, O.; C. B. Adams, Great Northern, St. Paul, Minn.; S. A. D. Forestall, Boston & Maine, Boston, Mass.; George C. Sperry, Mexican Central, City of Mexico, Mex. P. W. Drew, of the Wisconsin Central, and E. E. Rittenhouse, of the Atchison, Topeka & Santa Fe, Deming, New Mex. were transferred from the honorary to the active membership list.

The treasurer's report, which was then read, showed a healthy condition of financial affairs.

The next order was the reading of a very instructive paper by W. F. Taylor, of the Pennsylvania Railroad, entitled "Standard Construction of Telegraph Lines."



M. B. LEONARD, PRESIDENT ASS'N RAILWAY TELEGRAPH SUPERINTENDENTS.

An interesting discussion followed the reading of the paper, Messrs. Selden, Gemmell, Lattig, Lockwood, Drew and Lang taking part.

Secretary Drew read a letter from Mr. Thos. A. Edison, in which that gentleman expressed his regret at being unable to be present. Mr. Edison said he was so busy that he hadn't time to sleep.

Letters of regret for inability to be present were also read from President O. C. Greene, U. J. Fry and Ralph W. Pope.

The courtesy of the free use of the Great Northwestern and Western Union Telegraph lines was extended to the members by Mr. J. Stevenson, superintendent of the Grand Trunk Railway, and H. P. Dwight, of the Telegraph Company.

The election of officers was then proceeded with and resulted as follows: President, M. B. Leonard, Chesapeake & Ohio, Richmond, Va.; Vice-President, J W. Fortune, Grand Trunk Railway, Detroit; Secretary and Treasurer, P. W. Drew, Wisconsin Central, Milwaukee, Wis.

Fortress Monroe was the place chosen for the next annual meeting, and June 17, 1896, the time. It was ordered that the Train Despatchers' Association be informed of the selection of place and date of the next meeting, so that that association could consider the advisability of holding its next annual meeting at the same place and time. The meeting then adjourned until 8 P. M.

The afternoon was spent very pleasantly in a carriage drive around the city and up Mount Royal. All the members and the ladies of the party availed of the opportunity to thus see the city, and the ride was extremely enjoyable.

At the evening session Mr. C. A. Parker read a paper on "Telegraph Line Construction," and an animated and practical discussion of the subject followed, Messrs Lattig, Taylor, Drew, Selden, Annett, Hammond and others taking part. A committee of seven members was appointed to draw up specifications for standard line construction and to report at the next meeting.

A paper entitled "Electric Traction on the Baltimore & Ohio," prepared by Dr. Louis Duncan, of the Johns-Hopkins University, Baltimore, was then read by Mr. Selden Mr. Selden introduced the paper by giving a brief sketch of the causes which led to the adoption of electric power for the operation of trains through the recently completed tunnel in Baltimore. "Trains are now running," he said, "at a speed of 40 miles, and the tunnel is lighted by electric lights placed at short intervals along the interior, no lights in the cars themselves being necessary." He then read Dr. Duncan's paper as follows:

BELT LINE POWER STATION AND EQUIPMENT.

BY DR. LOUIS DUNCAN.

The power house consists practically of two separate plants — the power plant and the lighting plant. The power plant consists of four (4) tandem, compound, non-condensing Allis-Corliss engines, with cylinders 24″ and 40″ in diameter by 42″ stroke. The crank shaft between the generator and fly-wheel is 16″ in diameter, the end of the crank shaft extending through a high-back pillow-block upon which the armatures of the generators are keyed. These engines will develop about seven hundred (700) horse power each. The balance-wheel weighs about 35,000 lbs., which in connection with the balancing effect of the armature, is sufficient for the best results in regulation. Between the high and low pressure cylinders is placed a suitable reheating receiver, and a wedge adjustment in the back pillow-block is so designed that the armature may be centered in the ring while the machine is in operation.

The four generators, whose armatures are keyed directly upon the shafts of these Corliss engines, are of the multipolar type, now so generally turned out for railway work. Each machine has 10 poles, 10 brushes, is compound wound, and capable of delivering 500 K. W. at 700 volts, running at 110 revolutions per minute, so there is a capacity of about 3,000 amperes for electrical traction purposes. The leads from these machines to the switchboard are of stranded copper something over $1\frac{1}{4}$ inches in diameter. The switchboard, which contains the ammeters, circuit breakers, rheostats, etc., is placed on a platform about six feet above the floor at the south end of the engine room, so that anyone standing by the switchboard has a view of the entire engine room, and complete control of the four power generators. The north end of the power house is occupied by the lighting plant, which consists of four standard Armington & Sims cross-compound, non-condensing, double-disk, two-wheel self-contained engines, whose cylinders are $16\frac{1}{2}$″ and 23″ in diameter by 15″ stroke. Two of these engines are belted directly to eight 50-light arc machines, using tandem belting. These engines run at about 250 revolutions per minute, and develop 250 horse-power each. The balance of the lighting plant consists of the other two of these engines, which are belted to two 120-K. W. alternators. These machines, running at about 1,000 revolutions per minute, develop

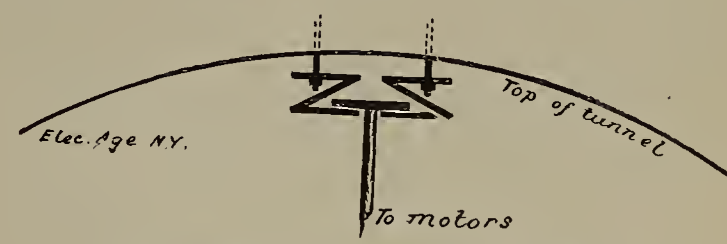
about 1,000 volts, and are used for incandescent lighting. The switchboard that controls these arc and incandescent machines is placed very near them, at the east wall, and consists of an arc plug-board which controls the arc lights, two alternator panels, and two feeder panels, which control the incandescent lights.

The boiler room contains eleven 250 horse-power water tube Abendroth & Root boilers, which are to be operated at 130 lbs. pressure per square inch, one 3,000 horse-power Webster feed-water heater, two Deane pumps, and the entire piping of the plant is duplex, so that in case of an accident to one branch of the piping, this branch can be entirely cut off and the other branch used. The Holley drip system is used in connection with the steam piping. One interesting and important feature in this plant is the size of the stack and flues. The top of the stack is only 60 feet above the grate surface, and only seven feet in diameter. To make it possible to use a stack of this size

DR. LOUIS DUNCAN.

for such a large plant the induced draft scheme has been adopted. The plant is equipped with two large draft fans, built by the Boston Blower Co , which give a maximum velocity to the flue gases of about 36 feet per second, or about 25 miles per hour. These fans are operated by a small engine placed directly under them and belted to them.

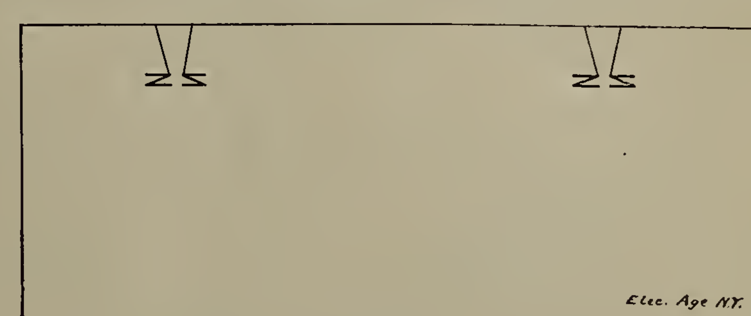
The overhead conductor of the current for the locomotives is an iron trough which is composed or two Z bars riveted to a cover plate 12″ wide, and leaving a slot one inch wide between the Z bars, so that a contact-maker may be drawn along through this trough. The conductor is suspended above the tracks in the following manner: At distances of about 150 feet, light iron columns with cross trusses are erected, and from this is hung a chain of long iron links. From this catenary construction the trough is suspended, being insulated with large porcelain insulators. Through a hole in these insulators, which are conical in shape, a bolt is passed and a casting fits down over the insulator, thus forming a suspension which supports a transverse channel, the channels being insulated from the conductor by a similar suspension; thus we get a double insulation and it is necessary for both insulators at a point of suspension to be defective in order to cause a leak. In the tunnel this trough is supported by expansion bolts cemented in the masonry of the tunnel. There is a conductor for each track, both suspended from one catenary, except at curves where there are two chain suspensions, and the troughs are allowed in this way to conform more closely to the curvature of the track. The current is supplied to the overhead conductor by means of three heavy copper cables, which are stretched along between



OVERHEAD CONSTRUCTION IN TUNNEL.

the iron troughs and at intervals are tapped into the conductor. The conductor is bonded with copper wires at its joints, and the feed wires are tapped in by soldering them to these bond wires.

The apparatus which will be used for taking off the current to the motors, and which corresponds to the ordinary

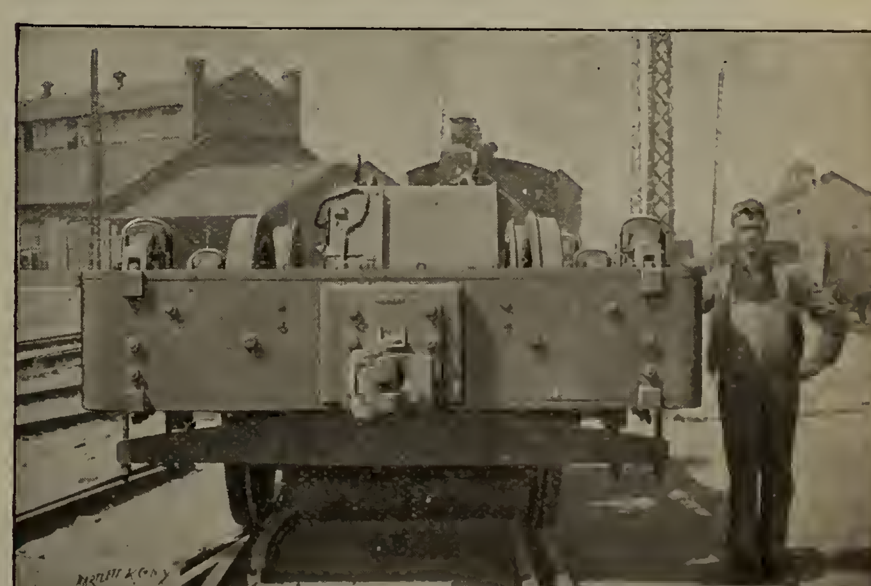


OVERHEAD CONSTRUCTION IN THE OPEN.

trolley wheel, is a large brass shoe, over two feet in length and about seven inches in width.

This trolley shoe will weigh about 25 lbs., and is connected to the locomotive by a device which automatically adjusts itself for different heights of conductor and curves.

The locomotive is made up of two units, each consisting of an iron truck frame, supported by four driving wheels. The motive power is furnished by two 6-pole axle motors; these motors are flexibly supported and trans-



END VIEW ELECTRIC LOCOMOTIVE.

mit their power to the wheels by means of flexible connections. The total weight of a single motor is about 25,410 lbs.

The locomotive is equipped with sheet iron cab, series-parallel controller, electric air pump, air brakes, air whistle, bell, safety devices, etc. It also has a Janney automatic coupler at each end.

Weight	95 tons.
Draw bar pull	47,500 lbs.
Height over all	14′ 3″
Length over all	34′ 8″
Width over all	9′ 6¼″
Wheel base of each truck	6′ 10″
Diameter of driving wheels	62″
Number of drivers, cast steel centres and steel tires	8
Size of journal	6″x8¾″
Gauge	4′ 8½″
Voltage	500
Maximum speed per hr.	50 miles.
" " full draw bar pull, "	15 "
" " half " " "	30 "
Number of amperes at maximum draw bar pull and 15 miles per hour	2,700 amp.

The motors are wound for 250 volts and are to be run wo in series.

The track, which is used as part of the return circuit, is ery heavily bonded with copper wire, and between the racks is laid in a wooden trough a large copper cable which is cross-connected to these bonds electrically; thus ve have all four rails as well as this heavy copper cable o carry the return current.

In the discussion which followed, Messrs. Lattig, Lockwood and Leonard expressed the belief that electric power for the propulsion of trains on railroads at present operated by steam power was one of the probabilities of he near future.

Mr. Lockwood thought that the trolley would eventually give way to the original and simpler plan of using a third ail as the conductor.

The meeting then adjourned until 9 A. M. Thursday.

At Thursday morning's session, Mr. J W. Lattig read Mr. Ralph W. Pope's paper on "The Practice of Placing Responsibility on the Young and Inexperienced."

This paper was followed by one on "Uniformity," by . C. Ford, which was also read by Mr. Lattig.

places without being noticed. Some of them are very poor operators, being appointed because they are honest and well meaning, and within a short time you hear this kind of men talking about their seniority. Mr. Ford discussed the propriety of having a registering machine on every train wire. If all conversation between dispatchers and operators were on record it would often facilitate the administration of discipline.

At the conclusion of the reading of these two papers the President, on motion, appointed Messrs. Selden, Lang, Darlton, Sholes and Kinsman a committee to confer with the American Railway Association in the matter of standing rules

Mr. T D Lockwood then read a paper on "Remedies for Inductive Disturbances in Telegraph and Telephone Lines."

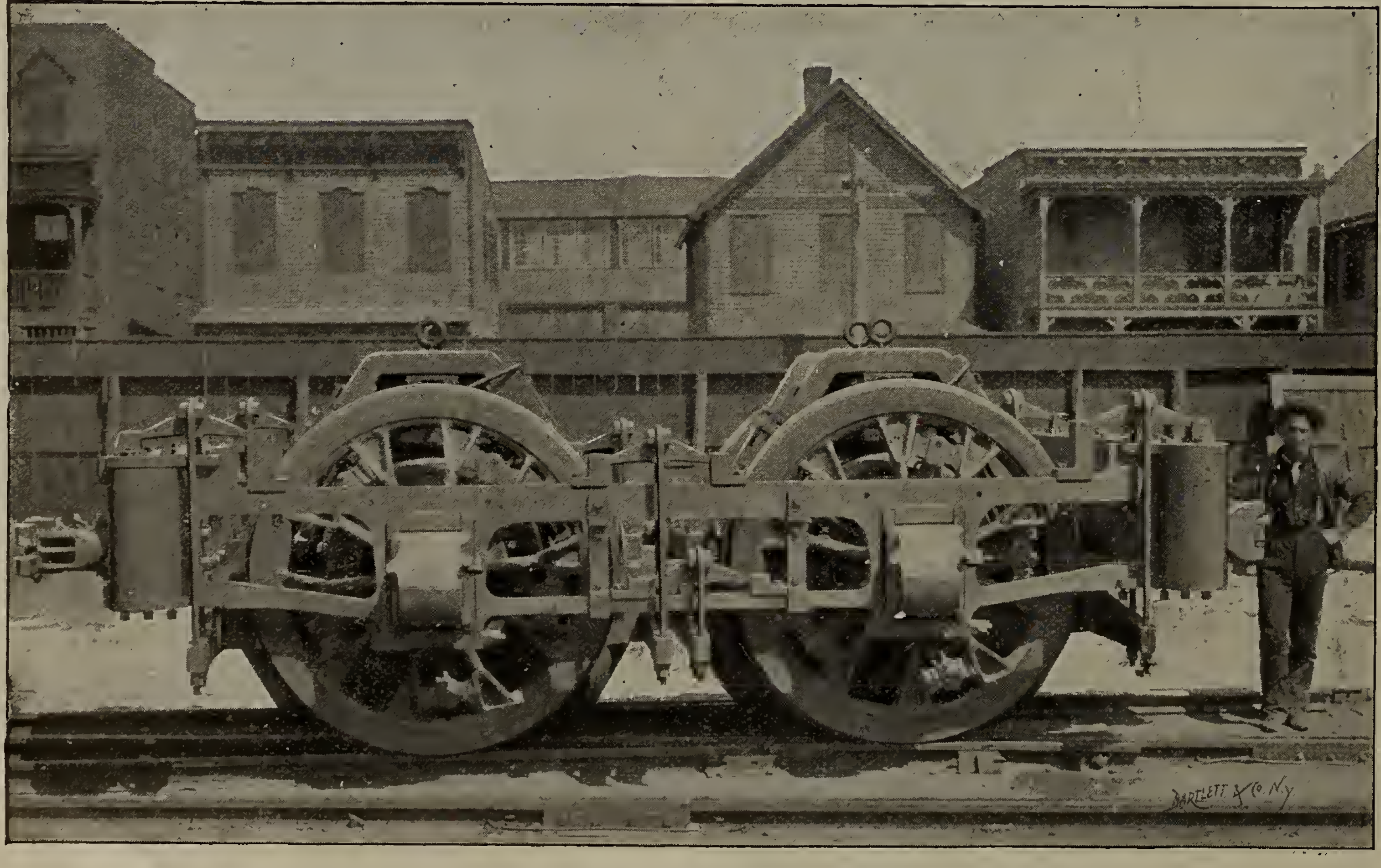
An interesting discussion ensued, which was participated in by Messrs. Selden, Hammond, Gemmel and Ryder, all complimenting Mr. Lockwood on the practical value of his paper. A part of this paper will be printed in a later issue.

Mr. G. H. Thayer's paper on "Trolley Currents and Automatic Signals" was then read by Mr. G. L. Lang. This paper will be found printed elsewhere in this issue.

Messrs. Lang, Ryder, Lattig, Lockwood, and J. B. Stewart discussed the paper at considerable length. The troubles referred to by Mr. Thayer had been experienced by all the speakers on their own roads, and they told what remedies they had adopted, and suggested other methods of overcoming the evils.

The next paper was that of C. F. Annett on "Storage Batteries," and it was followed by one on "The Electrical Accumulator," by J. B Stewart. An abstract of Mr. Annett's paper will appear in a later issue. Mr. Stewart's paper is printed on another page in this issue.

The two papers, being practically on the same subject, were discussed together; various members participating. The discussion showed plainly that the accumulator is rapidly extending in use in telegraph work, and is giving the most satisfactory results in practice.



ELECTRIC LOCOMOTIVE, BALTIMORE & OHIO R. R. TUNNEL, BALTIMORE, MD.

Mr. Ford emphasized the necessity of examining applicants at an early stage; that is before they become students. He keeps students' records in the same book with the operators. If students are allowed to come into offices along the road without supervision they work into regular

The chair announced the committee on Standard Line Construction—Messrs. Taylor, Parker, Annett, Hope, Lattig, Stewart and Dyer.

Committee on Topics—Ryder, Torrey and Magiff.

(*Continued on Page 352.*)

THE ELECTRICAL ACCUMULATOR.*

BY J. B. STEWART.

This subject is receiving greater consideration to-day than ever before, because it is an admitted fact that under the present systems of generating and distributing electrical power there is a great waste, and if this wasted energy can be held in storage until actually needed, there will be a very great saving effected.

J. B. STEWART, SUPERINTENDENT OF TELEGRAPH, WEST SHORE RAILROAD.

The sharp competition between the different lighting systems, and the demand of the people for cheaper light, has incited the efforts of inventors and electrical engineers to solve the question of cheaper generating plants and of economical distribution.

The question of railroad transportation by means of electrical power cannot be advanced until this is settled; we will, of course, admit that the introduction of compound engines, with the alternating generators coupled direct, has reduced the cost of operating to a certain extent, but we still have the same expense for labor and coal for both day and night service, whether the power is used or not. This statement applies particularly to small plants maintained by railroad companies.

What can be done to reduce the cost of electric light and power transmission?

As the storage battery has been so often described, it is not necessary for me to go into a detailed description of it, but I will give you the result of our experience and the possibilities suggested thereby.

We have at our New York terminal a main battery of seventy cells of the Chloride type C 3, and, two cells of type E 7 for locals; prior to the installation of this plan, which was about October 1, 1894, we had two banks of main battery of the gravity type, one of one hundred and forty cells, another of fifty cells, and also forty-eight cells for locals. These batteries required a room 12x12; our present main battery of seventy cells is kept in a closet five feet long, four feet high and ten inches deep, and located in the dynamo room. Each cell has a nominal capacity of 12½ ampere-hours, with a nominal discharge rate of 1¼ amperes and a pressure of a fraction over two volts. As our wires consume only $\frac{12}{100}$ ampere-hour, we can carry our service five days without recharging.

This battery is fed from an arc light machine carrying 16 to 18 amperes, and a pressure of from 300 to 360 volts, according to the load; the feeding wires are simply "tapped" on to the main circuit and the draught is regulated to about one-half ampere by means of incandescent lamps, connected in series, in the feeding circuit. Both terminals of the main battery are connected to the switchboard in the telegraph office, so that it is always available for use as an intermediate or for testing purposes. The distribution to the different circuits is regulated by means of lamps of various resistances, each wire having its own lamp or lamps connected in series to reduce the current to just what is needed for the proper working of each wire; these resistances absolutely prevent any interference as between wires connected to the same battery through the grounding, or other causes, of any particular wire or wires.

All of our wires, with a mileage ranging from 1 to 451, are fed from this one bank of seventy cells, without any of the difficulties experienced with gravity battery.

The switchboard connections are the same as have been described in the late issues of the Electrical Age.

The local cells—which have a capacity of 150 ampere-hours, with a nominal discharge rate of 15 amperes—are connected directly in series with the arc lamps, so that the total output of the machine passes through them. By means of a double-pole switch one local cell is always connected into the arc circuit for charging while the other cell is feeding the twenty-one sounders. Each sounder will consume about one-quarter ampere-hour when closed; at this rate the twenty-one sounders would about exhaust the cell every twenty-four hours if all remained closed; but it is fair to assume that two-thirds of the local circuits are open as much as they are closed, therefore the average is much less, and within bounds, to place it at three ampere-hours per sounder per day. At this rate of discharge the local cell will carry the service for two and one-half days; as a matter of fact, we were obliged to use them for five days without recharging, while our dynamo was being repaired.

CHLORIDE ACCUMULATOR.

The first cost of the Chloride cell type C 3 set up and ready for service is about two dollars, and for type E 7, about ten dollars.

The cost for maintenance of our gravity battery was

* Paper read at the convention of the Association of Railway Telegraph Superintendents, Montreal, Que., June 12 and 13, 1895.

about one dollar and sixty-five cents per cell per annum, without considering the value of the room occupied by it; therefore it is obvious that the expense of maintaining our gravity battery for one year was more than enough to purchase the storage plant.

The cost for maintenance of this storage battery is nominal, say ten per cent. for interest and depreciation, for there is practically no expense for charging—the amount of coal used is just the same as before the battery was put on, and the ammeter is not deflected when the battery is switched in or out—in fact, we cannot detect that the feeding of these cells has added anything to the load of the machine, which by the way, is rated to carry ten arc lamps, and it was carrying that number when the battery was connected, but since that we have put on an additional lamp.

It is asserted that the acid put in the solution, when the battery is first set up, always remains and only the water evaporates, therefore the only attention required is to keep the cells full of water and the connections well greased. An experiment is now being made to reduce the evaporation of water to a minimum by filling in over the top of the cell with wax.

I cannot give you anything definite with regard to the life of this battery, but the manufacturers claim that if the discharging rate is kept within its capacity and the terminals kept clear of acid, it will last a number of years.

You will notice that I have mentioned the chloride accumulator only. My reasons for this are:

First.—That it is controlled by the company owning the Brush and other basic patents, which have been settled by the courts in favor of the Brush company, therefore the public can now purchase without fear of a lawsuit for damages.

Second.—The form of construction, and assembling, is such that, to my mind, there is no chance for the plates to buckle or the pastilles to get out of the plates and short circuit the cell. This, as you know, has been the main cause for failures in the past.

Third.—It is one I have had the most experience with and know what it will do.

The storage battery will, undoubtedly, be the direct power used for operating the automatic block signal systems, which, I believe, all of the large railroads will adopt within the next few years; four to six cells of storage battery placed at each signal, and charged by generators placed at water stations, will furnish the power to operate the semaphore, which, in my opinion, will be the type adopted as the standard signal.

Railroads having their own lighting plants will find the storage battery a very useful and economical adjunct.

Take, for example, a plant wired for one hundred lights; probably not more than twenty are used after ten or eleven P. M., and yet the plant must be kept running all night to supply the twenty lamps. Now if we add to such a plant fifty-eight cells of storage battery of the proper capacity, we will have power to carry one hundred and twenty 110-volt lamps while the generator is running, and the battery will furnish current to carry the twenty lamps after the machine has stopped, and at the same time feed your telegraph wires. It is, of course, understood that the generator must be run a sufficient length of time to properly charge the battery, and, also, that if cells of larger capacity are used, the generator can be run by the shop engineer during the day to charge the battery sufficiently to carry the night service.

I believe that the storage battery will solve the problem of cheap lighting. First, by providing for the installation of smaller engines and dynamos, and running them at full load, which is the most economical; and, Second, by running the dynamos only when actually needed, which, in the smaller places, would probably be until midnight and, in the cities where day service is also furnished, the machines can be kept running all night, charging the batteries in the latter half, when the load is light, sufficiently to carry the day service, and thus dispense with the day force of men and effect a large saving in coal consumption.

The storage battery will also be used for trolley lines, and thereby not only effect a saving in expenses by storing the power now wasted while cars are standing, but to furnish a uniform pressure whenever required by the motors, and also, what is of still greater importance, to provide the power to carry the service in case of breakages making it necessary to stop the generators for a short time.

Let me illustrate: A properly designed electric railroad plant would provide power sufficient to run a maximum number of cars under all conditions of the service; a motor, as you are aware, requires more power to start it and to ascend heavy grades than it does to run on a level grade after the maximum speed has been attained, therefore the generators must have the necessary power to start all the cars at one time and under all conditions. When this occurs, a sudden and heavy strain is put upon machinery, for which mechanical devices cannot as promptly compensate. This is especially true if water power is used. Now if we add storage batteries to this plant, we have not only an accurate and quick-acting compensator to meet such draughts, but we provide for an increased number of motors during the hours when the traffic is the heaviest. If this statement is admitted, we then have the means at hand to revive struggling trolley lines and, also, to aid those lines that have reached the limit of their power and have demands for increased facilities; and in a great many places it will enable the trolley lines to increase their revenue, by furnishing current for light and power purposes; the battery will at all times furnish a uniform pressure to the motors, or to the lighting circuits, and as no extra force will be needed at the power house, we can estimate that the additional expense will not be much more than the interest charge on the cost of installing the storage battery plant.

If we can judge by the number of installations made in Europe, we must conclude that the value of storage battery plants is fully recognized there and to a greater extent than in this country.

The latest statistics show that there are in Switzerland 161 storage battery plants, in connection with 740 lighting and power plants, and of the 116 new lighting plants established in 1893, 40 were equipped with storage batteries. In this country there have been a number of different kinds of accumulators tested and the majority of them failed. This fact, together with numerous law-suits, has led our people to the conclusion that the storage battery is expensive and unreliable; but, I believe, we can now say without fear of successful contradiction, that the storage battery has passed the experimental stage, and that if it is adopted by our light and power companies we shall soon see an improvement in the service of plants already established, and also rapid extensions, which will be justified by the decreased cost of operating—and finally, capital, which responded to the call of the magical power, will receive a just return.

TELEGRAPH LINE CONSTRUCTION.*

BY C A. PARKER.

Too much care cannot be taken in laying out the line to get it located in order to avoid unnecessary expense afterwards, also to make line more durable. Location where there is danger of washouts should be avoided, as well as good sites for new side tracks, steam shovel pits, falling timber, etc.

With us, in the mountains, snow slides, falling rocks, track changes to reduce curves, etc., are all matters that require special attention. During construction sharp curves and abrupt grades can often be reduced, as they are expensive to maintain after line is built.

On the Rio Grande road we have line in canons where there is solid rock on either side to contend with, where a

* Read at the Convention of the Association of Railway Telegraph Superintendents, Montreal, June 12 and 13.

line properly located is often less expensive to maintain than prairie lines, but if located wrong frequently entails expense of new location, which in one instance I recall cost $400 per mile for labor alone to move, which more care in making first location properly would have saved.

No rule will answer for proper locating of all lines. We must take in all the surroundings and then place the line where our experience tells us is the best. I have found it necessary at places to locate line 500 to 800 feet above the track to avoid snow slides, falling rocks, river and track changes, and yet at some of these places the line is not over 20 feet from an imaginary line run perpendicular from track. This is in the canons where snow slides and falling rocks go under the wires between the poles or fixtures.

Another great source of trouble is the baled hay wire. At some of the worst places, stock yards, livery barns, etc., a few 40-feet poles will raise the line so the stones and hay wires will fall short of the line and prevent a great deal of such trouble. This remedy will also apply at particular points where the small boy amuses himself breaking insulators by shying stones at them. The line that gives the most continued service at the least expense of maintenance is what we all want, and one of the best times to obtain it is during construction, or reconstruction, to see that it is located with this end in view.

The railroad companies find it money well spent to get the best civil engineers to properly lay out their railroad, and the same applies to their telegraph lines. I have often taken two or three men and changed a line of stakes, laying out a mile of line several times, avoiding grades, washouts and bad curves, also places where it would be difficult to dig a hole on account of water and boulders. This extra care has always met with satisfactory results in saving, sometimes at times of construction, other times in after years in maintenance. A good foreman will always keep his line thoroughly laid out ahead of the work, to avoid changes after partly constructed. More time in laying out a line will often repay a hundred times in saving of expense, to say nothing of the advantage gained if some of the interruptions are avoided.

A pole set in a ravine should, if possible, be avoided, as it not only looks bad, but is a menace to proper maintenance and often a cause of trouble, when a broken glass allows wire to swing from the pole and cause a cross. In case of a storm the tall pole, where wires leave a ravine, often proves to be the weak spot that will allow miles of wire to go down, on account of the extra strain on the high pole in the line, where the grade of wire is so uneven that when once the pole is broken, gives slack to assist the storm in tearing down the line. Where it cannot be avoided with a long pole, or diverting line to a more even grade, a long span is often preferable.

TROLLEY CURRENTS AND AUTOMATIC SIGNALS.*

BY G. N. THAYER.

On one of the western trunk lines entering Chicago it was noticed, not long since, that a block semaphore, operated by the track circuit, remained in the safety position when a rail was removed. Investigation showed that this was caused by stray currents from a neighboring street car line operated by electricity.

The possible damage from such leaks led the writer to make a series of tests on a section of the Chicago and Northwestern road in the outskirts of Chicago, where a trolley road is in close proximity.

The trolley line runs parallel with the steam road for about five miles, with two grade crossings. The distance between the two roads varies from one hundred to two thousand feet. The steam road is double track and equipped with automatic signals operated by wire circuits.

Tests with Weston instruments showed a difference of potential between rails varying from one-half to five volts, and in a few instances the pressure ran up to fifteen volts for a short time. The readings were taken about every two thousand feet over the entire five miles. There was no part of the section tested that failed to show the presence of the leaking current. At the two crossings mentioned, the rails of the steam road had been insulated in the usual manner with wooden fish-plates and fibre wedges, preparatory to changing the signals from the wire to track circuit; and over these fibre insulations a current would flow sufficient to bring a five-volt lamp up to candle-power and to melt a three-ampere fuse. These tests were made about the middle of November last, before the ground was frozen. Similar tests were made in January, with the ground frozen solid, and the results were found to be practically the same.

No effect was noted on the wire circuit signals, but on one section, which had been fitted up with the track circuit (the signal being located near the crossing of the roads), the signal would go to danger upon the approach of a trolley car and then resume the clear position after the car had crossed and passed on some distance. This action was accounted for on the ground that the trolley current was of opposite polarity to the signal current, thus de-energizing the signal magnet.

The possible effect on a system of track circuit signals from leaking trolley currents may well attract the attention of this association. While it may be true that, as a rule, a pair of wheels entering a section will short circuit both the battery current and the stray trolley current, thereby throwing the signal to danger; yet under some conditions it might not do so completely, and a train might occupy such section with a clear signal behind it.

The destructive effect upon water and gas pipes through electrolytic action, caused by leaking currents from street railways using a ground return, is well known. The time is not far distant when the municipal authorities and gas interests will find themselves confronted with enormous expense for renewals of pipes. This of itself may result in such radical changes in street railway construction as will insure a perfect return of the current to the power house independent of any pipes tracks or other conductors that may be in its path. In Chicago where an extensive system of electric street car lines is under construction, great care is being taken to do this. In addition to securing as perfect binding or rails as possible, heavy return wires are being erected on the poles. These return wires are connected to the rails about every thousand feet. The street car people expect that this will prove an effectual remedy. It remains to be seen whether their expectations can be realized. It is not among the impossibilities that the union of the two dissimilar metals at the rail joints and where the return feed wires are attached to the track, may sufficiently deteriorate from local action as to insert enough resistance to cause some of the current to seek pipes, rails and other interposing metallic paths in its effort to return to the buss bar at the generating station. Time alone will settle this point. When it is considered that only one-tenth of a volt will hold a signal to safety when it is once up, even a small leak from a neighboring street car line is highly objectionable.

The absolute remedy for this difficulty is the double trolley. While strong arguments can be advanced against its use and in favor of the single trolley, the fact that one large city (I refer to Cincinnati) has the most of its street car lines fitted with double trolleys, and further that they are in satisfactory and successful operation, weakens the position of the single trolley advocates.

* Paper read at the convention of the Association of Railway Telegraph Superintendents, Montreal, June 12 and 13, 1895.

VICE D. F. LEWIS.—E. G. Russell, superintendent of the Rome, Watertown and Ogdensburg R. R. system, has accepted the offer of the position of president of the Brooklyn Heights Transit Company. He will have entire control of the management of the reorganized Brooklyn Heights Company.

(*Continued from Page 348.*)

Committee on Arrangements and Exhibits—Darlton, Walstrum and Selden.

The meeting then, at 1:15 o'clock, adjourned till 5 P. M.

After dinner the Grand Trunk Railway took the party in a special train on a visit of inspection of the Victoria Tubular Bridge across the St. Lawrence.

The visitors alighted at the centre and examined the great engineering work. On the return trip an opportunity was given to examine the approach at the Montreal end of the bridge.

The meeting reassembled at 5 o'clock and the first order of business was the reading of a paper by Mr. R. B. Gemmell entitled, "Some Suggestions on the Social and Moral Conditions of Railway Telegraphers"

This was followed by a paper on "Things Worth Knowing," by G. C. Kinsman, which was read by Mr. F. W. Wilson in Mr. Kinsman's absence.

When the reading of this paper was finished the secretary read a telegram from the secretary of the Train Despatchers' Association, in convention at Minneapolis, Minn., announcing that that association would hold its next annual meeting at Fortress Monroe, Va., on June 15, 1896, and expressed the hope that the relations of the two associations would then be more closely cemented.

After a short discussion of Mr. Torrey's paper, Mr. W. W. Ryder read a paper prepared by J. J. Burns on the subject of "Water Power in Connection with Electricity and Electric Locomotives in Railroading."

This paper was followed by one on "The Evolution of the Telegraph" by J. Q. Mason, which was read by Secretary Drew.

On motion of Mr. Selden, Dr. Louis Duncan of Baltimore, Md., was elected an honorary member of the Association. The names of several gentlemen in the railroad service were also placed on the honorary list.

The Committee on Acknowledgment of Courtesies then made its report tendering the thanks of the Association to the Grand Trunk Railway, the Canadian Pacific Railway, the Central Vermont, and Delaware & Hudson Railroads, the Great North-Western Telegraph Co., the Pullman Palace Car Co., J. W. Fortune, and other companies and individuals, for the many courtesies, and a special vote of thanks was tendered to Mr. Chas. R. Hosmer, General Manager of the Canadian Pacific Telegraphs, for his "liberality, geniality and hospitality" to the members and their wives.

The convention then adjourned to meet at Fortress Monroe, Va., June 17, 1896.

The Canadian Pacific Railway Co . pany extended the courtesy of free transportation to and from Quebec, and placed at the disposal of the members two special sleeping cars. These were attached to the 10 30 P. M. train for Quebec, most all of the party availing of this opportunity to visit this celebrated city.

On Friday, after breakfast at the Chateau Frontenac, the morning was spent in driving around the city and visiting the many points of historic interest for which Quebec is so famous. After dinner, through the courtesy of W. R. Russell, superintendent of the Quebec, Montmorency & Charlevoix Railway, the party made a trip on a special train to the Falls of Montmorency and then to St Anne, where the shrine of St. Anne de Beaupre is located. The magnificent church containing the famous relics was visited, and a priest, clad in his sacred robes, conducted the visitors through the building, and showed and explained to them the many features of interest.

On the return from St. Anne de Beaupre a few of the gentlemen of the party, on invitation of Mr. F. H. Badger, Jr., general manager of the Montmorency Electric Power Company, stopped over a train and visited the water-power station of that company. Mr. Badger and Mr. L. Burrian, the company's electrician, explained in detail, the main features of this interesting plant, which supplies all of the electric light current that is used in Quebec.

The party returned to Montreal on Friday night, and after breakfast on Saturday they took the morning trains for their respective homes.

Through the courtesy of the Grand Trunk Railway, represented by J. W. Fortune, the Pullman Palace Car Company and the Richelieu & Ontario Navigation Company, a party of the members came to Montreal from Niagara Falls via the Grand Trunk Railway to Kingston, and by steamer thence to Montreal down the St. Lawrence river. Several of the party returned to Niagara Falls after the convention, via the Grand Trunk, special accommodations having been provided by that road.

On Friday afternoon an elegant set of solid silver knives, forks and spoons was presented to Mr. and Mrs. J. W. Fortune, as an expression of the appreciation of the members of the association for the efforts put forth by Mr. Fortune to make the trip interesting and entertaining.

ATTENDANCE.

M. B. Leonard and wife, Richmond, Va ; C. Selden, wife and daughter, Baltimore, Md.; R. B. Gemmell and wife, Topeka, Kan ; L B. Foley, wife and son, New York; P. W. Drew and wife, Milwaukee, Wis.; S. K. Bullard and wife, Sedalia, Mo ; F. S. Spafard and wife, Cedar Rapids, Ia ; W. W. Ryder and wife, Chicago; C. F. Annett and wife, Chicago; J. F. Evans and wife Cleveland, O.; S. D. Caldwell and wife, Fort Wayne, Ind.; F. W. Wilson, Fort Wayne, Ind.; H. Johnson and wife, Chillicothe, O.; I. T. Dyer and wife, St. Joseph, Mo.; J. W. Fortune and wife, Detroit, Mich.; D. C. Matheson and wife, Flint, Mich ; M. Magiff, wife and daughter, St. Albans, Vt.; J. J. Linn and wife, Port Huron, Mich.; C. W. Hammond, St. Louis; C. A. Darlton, Washington, D. C.; C. A. Parker, Denver, Col.; G. B. McCoy, Memphis, Tenn.; M. A. Baker, Hannibal, Mo.; J. W. Lattig, South Bethlehem, Pa.; W. F. Taylor, Altoona, Pa.; N. McKinnon, Toledo, O.; E. A Cheney, St. Louis, Mo.; C. E. Carson, St. Louis, Mo.; Dr. P. L Clark, Chicago; W. S. Logue, New York; T. D. Lockwood, Boston; T. R. Taltavall, New York; G. L. Lang, Boston; E. A. Smith, Boston; S. A. D. Forristall, Boston ; C. H. Whall, Boston; Charles Blizard, New York; J. B. Stewart, Weehawken, N. J.

EXHIBITS.

Mr. Charles Selden showed a new telephone in practical operation. The apparatus consisted of a Collier receiver and Brown transmitter, both English inventions A line was run to a distant part of the hotel and the talking powers of the instrument were tested. Conversation and whistling carried on several feet away from the transmitter were reproduced with remarkable loudness and distinctness. American patents have just been issued on this instrument and arrangements are now being made for its manufacture in this country. A Canadian company is also being formed. Mr. Selden controls the American and Canadian patents.

Dr. Percy L. Clark represented the National Self-Winding Clock Company, Chicago, and exhibited one of the clocks. This clock is wound every 15 minutes by the simple action of a pair of magnets and a specially designed cam movement. By the use of the magnets all of the complications incident to the use of electric motors are avoided. The synchronism and winding is effected by the same current from one battery, and provision is made to avoid evil results in case of crossing or other derangement of the synchronizing circuit.

Mr. Charles Blizard, of the New York office of the Electric Storage Battery Co., Philadelphia, exhibited six cells of the well-known "Chloride-Accumulator," two of six ampere-hours capacity; two of 12½ ampere-hours, and two of 25 ampere-hours. These cells showed the plates in the various stages of manufacture.

ELECTRIC LAUNCHES AT ATLANTA.—The contract for the electric launches for the lakes at the Cotton States and International Exposition has been let to Gen. C. H. Barney, of New York. The launches will be made of cedar, with oak frames and mahogany decks.

PRINCIPLES OF DYNAMO DESIGN.

BY

Newton Harrison E.E.

(*Continued from Page* 336.)

The elimination of this E.M.F. is in certain cases an absolute necessity. An alternating current by its continual variations is producing a magnetic field that also changes, and by these changes induces within its own and surrounding circuits a varying E.M.F. It is not a phenomenon of rare occurrence; on the contrary, it plays its part in the armature coils as nothing else could, to reduce what would otherwise be excessive flows when subjected to sudden electrical and, incidentally, magnetic changes. As the principle underlying the theory of self-induction is so well established as to admit of no doubt, and as it may be seen that its development and growth are dependent upon conditions that do not actually differ from those incident to the production of any other E.M.F., self-induction may, therefore, be considered under this heading, called the generation of E. M. F., and looked upon in every sense as a reactive or superposed pressure. The classification of armatures has clearly shown the two prevailing types of today. Yet it often occurs that a core having the dimensions of a Gramme may be wound as a drum. If an inductor is cutting lines of force with a certain velocity, say 10 feet a second, the armature core upon which it is placed can rotate at a slower speed per minute as its diameter is gradually increased. A Gramme armature, therefore, can have the same peripheral or circumferential velocity with few revolutions as a drum armature of a smaller diameter and a much greater speed per minute. Therefore, if a given E.M.F. is to be generated and speed is limited to but few revolutions per minute, either a strong field or a great number of inductors will be required to compensate for the reduction in speed

The 10 feet a minute can be produced either by the use of a Gramme or a drum armature core. There is no need of having an abnormally strong field or insisting upon the employment of an armature of very many inductors. It is a simple matter to use a Gramme armature of the proper diameter to give the required peripheral speed and still revolve slowly enough to satisfy the prescribed conditions. It is therefore evident that there would be no sense in revolving a Gramme armature at a high speed or a drum at a low speed, for each will fulfil its work with perfect excellence if it be intelligently considered. The Gramme winding is therefore specially adapted to slow-speed machinery; it is also an advantage to use it aside from its mechanical features, because the two points of greatest potential are widely separated and the difficulties that usually confront us in the insulation of drum armatures disappear to a large extent.

A drum winding means less wire per volt than a Gramme. It also requires a core of solid and substantial structure which in construction offers no mechanical difficulties.

At one time it was the most popular form, but has been to some extent superseded by the Gramme. For high-speed machines it is specially adapted. If the new steam turbines, running at a speed of from ten to forty thousand revolutions per minute, were to be applied to electric light work, the only type of armature that could possibly succeed would be the drum. Such being the position for which each is particularly fitted, there need be no future question regarding the kind of work each is called upon to perform.

The above descriptions have been given for the purpose of illustrating the two leading varieties of armatures, more as regards their general purpose than with the idea of discussing their technical characteristics.

While the Gramme or drum type may be of such value as to call for general application, a seemingly composite type has been evolved, which owes any essential differences to the fact that the field surrounding it is not of the ordinary bi-polar form, but consists of a field produced by the concentered action of four or more pole-pieces. It can be easily understood that conditions have changed if, instead of using two pole-pieces, some multiple of two is used. The system of commutation would have to be changed, because between each two pole pieces there would be a complete reversal of current, and if these periodic changes, which inevitably occur, be not properly rectified throughout the system, disturbances would occur that would seriously interfere with its proper action. Provision must therefore be made, so that the E.M F. induced by each pair of pole-pieces will be led at the proper instant to the brush or cummutator bar communicating with a similarly directed E.M.F. from another portion of the armature that is then being acted upon by another pair of poles. The conditions represent two or more machines so joined as to have a common set of inductors and magnetizing the same armature core.

It may be inferred from what has been said that the requirements of practice have a decided effect upon the type of machine to be employed. This is to a large extent true, but not necessarily so, because any style of frame can use either type of armature and be commercially successful. One of the most peculiar armatures, both as regards its construction and winding, is that of the Thomson-Houston arc light dynamo. Its frame, even, is of curious workmanship, making the machine in total one of the most unique in design.

Without carrying the discussion of the armature outside of the proper sphere of this division of the subject, it would be well to state that in all cases, as in engine design, strange types may appear, whose object it may be to create sensation and talk; yet in spite of this fact they do not endure, because to a trained eye there is as real a beauty in a well-designed machine as there is in the perfect finish of a sculptured form, and the consumer or buyer is gradually learning to discriminate.

According to the purpose of the machine the method of winding is determined, and this is again governed by the E.M.F. it is to produce. As a rule high tension, continuous-current machines are series wound, and low tension are shunt wound, while a composite type of winding used for the preservation of a uniform E.M.F. is called compound winding. Pressures of from 1,000 to 5,000 volts are produced by series-wound machines, that is to say, dynamos in which the armature and field are connected directly in series. In these machines the constancy of the current is the primary object in view, so that the first class might properly be called constant-current machines. The second type, whose object it is to supply a constant pressure to the lamps, has for its first illustration the ordinary shunt dynamo and as its second or adjunct type the compound-wound dynamo. The failure of the shunt machine to supply a uniform pressure led to the development of the practice of compounding.

(*To be continued*).

UNION COLLEGE.—The Editor of the ELECTRICAL AGE acknowledges the receipt of an invitation from the president and board of trustees of Union College, Schenectady, N. Y., to be present at the Centennial celebration commemorative of the founding of the college. The exercises will begin on Sunday, June 23, and end on Thursday, June 27. An exceedingly interesting programme has been prepared.

—A well-made, well-set and well-cared for engine is as reliable a piece of machinery as the ingenuity of man has yet devised, but, if ill-treated, even the best engine will go on strike with extraordinary persistence.

The magnets of large dynamos often take ten minutes or more to rise to their working stage of magnetization.

TRYING TO SMOTHER TELEPHONE OPPOSITION.

It is reported that the New York and New Jersey Telephone Co is making overtures for the absorption of the Montauk, Orient and New York Telephone Co., Long Island. A meeting of the stockholders of the latter company is called for June 27, to consider the matter. Bad faith is charged by some of the stockholders, in that their company's interests are being played into the hands of the monopoly. A despatch from Cutchogue, L. I., says:

"At first the representatives of the monopoly proposed that the new company increase its capital stock to $50,000 and give the monopoly 60 per cent. This was promptly voted down. Then the New York and New Jersey Company proposed to buy all the stock of the company at par and to reimburse the company for all expenditures to date. Of course this latter proposition was not made until after the representatives of the old monopoly had made sundry bluffs. They told what the monopoly proposed to do about taking possession of the territory and building its line, whether they had competitors or not. They frightened the more timid of the stockholders of the local line into agreeing to a plan which, in substance, was to surrender to the New York and New Jersey Company all the right of way and sundry other considerations they had acquired for nothing.

"Right here is where the charges of treachery and bad faith come in. The right of way for the local company was acquired from the owners of the land between Riverhead and Orient. In many cases the right of way was presented because it was to a local company whose line would be in the nature of one big circuit, for the privilege of using which every subscriber would be required to pay only $30 a year and no tolls. The plan of the company was to establish a local service. If any man in Orient desired to talk to a subscriber in Riverhead or Cutchogue, all that would be necessary would be to ring up the party. There would be no toll beyond the mere annual rental. The company is a good thing and hits directly at the monopoly.

"If the New York and New Jersey Telephone Co. succeeds in fixing its clutches on the community at eastern Long Island, it will be too late to revive the local company. The plan proposed by the local company is a good one. It would make the telephone available to the villages covered, at a low proportion of the cost under the old company.

"The old company is said to be using every power and influence to smother the local company, which at the outset contested its monopoly."

BOUGHT PLANT AND BUSINESS.—The Automatic Circuit Breaker Co., Newaygo, Mich., on May 31 last, purchased the plant and business of the Sweet Electric & Mfg. Co., of Grand Rapids, Mich., and will continue the manufacture and sale of circuit breakers, limit switches and lightning arresters at Newaygo.

S. W. RUSHMORE.—The creditors of Mr. S. W. Rushmore have given him until December 1, 1896, to liquidate his indebtedness. He proposes to apply all net earnings after August 1st to reduce claims against him on merchandise account. Mr. Rushmore's liabilities are $8,975, and his assets, $8,244.

THE A. I. E. E. MEETING.—The convention rate of one and one-third fare on the certificate plan has been granted by the traffic associations to the members of the American Institute of Electrical Engineers who attend the Niagara Falls meeting on June 25th. Every one, member or non-member, who intends to go to the meeting should send his name to Secretary Pope, 26 Cortlandt street, New York.

PERSONAL.—Mr. Brown, City Electrician of Rochester, N. Y., was in town last week.

STATISTICS OF THE ALUMINUM INDUSTRY.

BY JOSEPH W. RICHARDS.

Scarcely any of our modern industries, rapid as has been their development, has surpassed the record made by the aluminum industry in the last ten years. Up to 1885, aluminum had been made exclusively by the sodium process; at that date the electrical processes began to take part. During the succeeding five years the competition was sharp, the sodium process in its struggle for existence was marvellously improved, but it was fairly "beaten out of its boots," and since 1891 the electrical processes alone have been in commercial operation.

In 1885, France was the leading producer. In 1886, Germany took the lead. In 1889, the use of Castner's process put England in the van. Since 1890, Switzerland has outstripped the rest of the world. Ninety-five per cent. of all the aluminum made in the last ten years has been made in the last five years, and seventy-five per cent. in the last three. During the ten years, the part contributed by France was 10 per cent.; England, 7 per cent.; Germany, 2 per cent.; Switzerland, 55 per cent. and the United States, 26 per cent. During 1894, however, only three countries were producers; France, 10 per cent.; Switzerland, 60 per cent.; the United States, 30 per cent.

Previous to 1885, the amount of aluminum made by the Sodium process may be estimated at 30,000 kilos in France, 10,000 kilos in England, and a trifling amount of 100 or 200 kilos in the United States. Adding this total of about 40,000 kilos to the amount made since 1885, we have a total weight of 2,900,000 kilos, or 6,380,000 pounds of aluminum made in the world from the start of the industry, in 1855, to the end of 1894.

The selling price of aluminum has decreased during the last decade as wonderfully as the output has increased. The price per pound has been as follows:

1885—France,	$12.00	per pound.
1886—Germany,	10.00	" "
1887— "	8.00	" "
1888—England,	5.00	" "
1889—United States,	2.50	" "
1890—Switzerland,	2.00	" "
1891—Pittsburgh,	1.50	" "
1892— "	1.00	" "
1893— "	0.75	" "
1894—Switzerland,	0.50	" "
1895— "	0.35	" "

If the same rule is to hold true of 1895, with the selling price $0.35, then we can reason backwards and say that the production this year to make a total value of $1,150,000 must be 3,285,000 pounds, equal to nearly 1,500,000 kilos. I think that this is very nearly what will be made, for there are at present in full operation, the Swiss works, with a capacity of 800,000 kilos; the Pittsburgh works, with a capacity of 400,000 kilos, and we may easily look for an output of 250,000 kilos from the Niagara works of the Pittsburgh Reduction Company during the six months of this year which they will be in operation.

Next year, with the Swiss works enlarged to an annual capacity of 2,000,000 kilos, the Niagara plant at full power producing 800,000 kilos, the French plants enlarged and the projected British works in operation, we may look for an output in the neighborhood of 3,600,000 kilos, or 4,000 short tons.

CORRECTION.—In our last issue was printed an illustrated article regarding the Mann Engine Lathe, in which it was stated that these machines were made by the Prentiss Tool & Supply Co., of New York. This was not quite correct. The machines are made *for* the Prentiss Company and not *by* them. The Prentiss Tool & Supply Co's. Chicago address is 62 and 64 South Canal street.

* *Aluminum World*, June, 1895.

DRAWBAUGH TELEPHONE.

The Drawbaugh Telephone and Electric Company, of Reading, Pa., has been organized to manufacture, buy, rent, lease and sell electric and magnetic telephones, electric machinery and novelties, and also to buy, lease, rent and erect telephone lines and exchanges and to manufacture, buy and sell telephone supplies and engage in and prosecute a general telephone business, using and operating telephones. Messrs. C. W. Ream and G. Milton Bair, 17 North Sixth street, Reading, Pa., are the sole owners of the late devices on telephones invented by Daniel Drawbaugh, the original inventor of telephones, and are actively engaged in presenting the merits and advantages of the new Drawbaugh telephone to the public. They have received permission from the Postal Telegraph-Cable company to use their poles within the city limits, and tests of great variety are made. The instrument used is a district, or short-distance phone.

The Drawbaugh phone is claimed to be superior to any other because of its transmitter, which is a simple arrangement, consisting of a sponge always adjusted and between the plates a carbon. There is no induction and sound is conveyed under seemingly the most adverse circumstances. A test was made by Mr. Bair, who stood five feet away from the phone and yet could be distinctly understood. He turned his back on the phone and his voice was heard, and he then closed the transmitter with his handkerchief, and still his voice could be plainly heard. A watch was held three inches away from the phone and the ticking was plainly distinguished at the other end of the line. These tests can not, it is said, be made with any other phone, because they have tried thirty kinds and all failed.

SELF-INDUCTION AND THE NIAGARA POWER PLANT.

In a recent lecture before the Royal Institution, London, on the subject of "Alternating and Interrupted Electric Currents," Prof. George Forbes called attention to the danger attending a sudden break in circuits which have large self-induction. In this connection he referred to the Niagara Electric power plant as follows:

In an alternating-current system, like that which has just been put in at Niagara Falls, the self-induction of the transformers is something very large indeed. And if we were to permit insulated cables to be laid in the earth over considerable distances, the capacity would also be very considerable of these cables. The combined effects of the capacity and of the self-induction would lead to a great deal of trouble, and it has been my effort to reduce the capacity of the cables, and to lay them in such a way that there should be as little capacity as possible, so that that source of trouble should be as much obliterated as could be. Also I introduced the plan of lowering the frequency of the alternations as low as possible, which also assists largely to get over troubles due to capacity. I need not go into that question of the reduction of the frequency at the present moment; but I may say that the further we have gone in the matter the more thankful we are that we realized the necessity in time, and have lowered the frequency to a figure that has never been reached before. It is not only an enormous safeguard to us in countless other ways, but it enables us to use apparatus of a simplicity which would have been impossible with the higher frequencies.

Now, neglecting the question of the capacity, let us deal simply with the question of self-induction. It is remarkable what great difficulty I have had in getting people to realize the danger that there is in suddenly breaking these circuits containing enormously powerful self-induction; but I have insisted throughout that it is indispensable to the success of that great work at Niagara that no circuit carrying large currents which are used with these self-inductions shall ever be suddenly broken. I found manufacturers relying simply upon their past experience, and not looking into the new conditions caused by the enormous size of the machinery. I found able manufacturers unable to realize this point. They had noticed, when they broke the circuit of an alternating current with some self-induction, large sparks at the switch. Several had the notion that if they could get rid of these, that was all they had to do. Their desire was to make the break at the switch as sudden as they possibly could, so as to prevent sparks and a train of fire from appearing there. As a matter of fact, by doing so they were endangering the whole system by introducing an enormous E. M. F. of self-induction tending to break down the whole system in one part or the other.

TELEPHONE PROTECTIVE ASSOCIATION.

In our last issue we noted the organization in Chicago of the above-named company. The officers selected were as follows:

President, J. E. Keelyn, of the Western Telephone Construction Co.; First Vice-President, J. R. Johnson, Viaduct Mfg. Co., Baltimore; Second Vice-President, S. J. Turnbridge, Utica Fire Alarm Telegraph Co., Utica, N. Y.; Secretary, Paul W. Bossart, Minneapolis, Minn.; Executive Committee, H. T. Johnson, Manhattan Electrical Supply Co., New York; P. C. Burns, American Electric Telephone Co., Kokomo, Ind.; H. C. Dodge, Standard Electric and Telephone Co., Madison, Wis.; M. O. Anthony, Cincinnati, Ohio; J. G. Ihmsen, Keystone Telephone Co., Pittsburgh, Pa.

"Organized force," says President Keelyn, "must be met with organized force, and the centralized efforts of the Bell combination should be encountered by opposite centralized efforts where conditions demand it."

New York Notes.

Office of the Electrical Age,
World Building, New York,
June 17, 1895.

The Gordon-Burnham Battery Company have moved to 82 West Broadway, corner of Warren street.

The board of directors of the Western Union Telegraph Company, on June 12, declared the regular quarterly dividend of 1¼ per cent.

H. M. Shaw, 126 Liberty street, is handling what is claimed to be the best dry battery on the market. On June 12 he sold 600 cells. He is carrrying a large stock of tempered copper segments for commutators, and dynamo and motor brushes.

Mr. W. H. Fleming, of 393 Pearl street, the oldest manufacturer of woven wire brushes, is doing an excellent business. He has lately taken out British patents and the brushes are now being made in Lancashire, England, to meet the great demand in Great Britain and the Colonies.

Mr. J. C. Dolph, 126 Liberty street, New York agent for the Forest City Electric Works, Cleveland, O., carries samples and a large stock of his company's goods. The Forest City Electric Works manufacture roll drop copper segments for commutators. These goods are meeting with much favor and orders for the same are rapidly increasing. The company has doubled the capacity of its factory and added a large number of new machines.

W. T. H.

COREY AND HARRISON.

Mr. H. H. Harrison has taken an interest in the lamp business recently established by Mr. R. B. Corey, in the Havemeyer Building. Messrs. Corey and Harrison will continue their headquarters in the present place, and no doubt the pair together will draw an immense trade.

THE ELECTRIC CONSTRUCTION AND SUPPLY COMPANY.

Chauncey G. Parker, Newark, N. J., receiver of the Electric Construction and Supply Co., has notified all creditors of that company to present to him their claims and demands against said company within three months from May 16, 1895. Failure to do this will exclude delinquents from the benefits of such dividends as may be made and declared by the Court of Chancery of New Jersey upon the proceeds of the effects of the company.

Telephone Notes.

NEWLY ORGANIZED TELEPHONE COMPANIES.

The Detroit Telephone Company, Detroit, Mich. Capital stock, $10,000.

The Electric Telephone Company, Claridon, Ohio, with a capital stock of $2,000.

The Neodesha Telephone Company, Topeka, Kan., by G. N. Bandy and W. I. Pierce. Capital stock, $5,000.

Topeka Telephone and Electrical Company, Topeka, Kan., has been organized to succeed the Harrison Telephone Company, with A. K. Rodgers, president; S. J. Bear, secretary and manager, and H. T. Ewing, assistant manager and electrician.

TELEPHONE PATENTS ISSUED JUNE 11, 1895.

TELEPHONE. Walter W. Scott, Buffalo, N. Y. (No. 540,-761).

TELEPHONE TRANSMITTER. Daniel Drawbaugh, Eberly's Mill, Pa. (No. 540,781).

TELEPHONE TRANSMITTER. Daniel Drawbaugh, Eberly's Mill, Pa. (No. 540,959).

CARBON-HOLDER FOR TELEPHONES. Daniel Drawbaugh, Eberly's Mill, Pa. (No. 540,960).

TELEPHONE-ELECTRODE. Daniel Drawbaugh, Eberly's Mill, Pa. (No. 540,961).

TELEPHONE. Daniel Drawbaugh, Eberly's Mill, Pa. (No. 540,969).

TELEPHONE TRANSMITTER. Charles Clamond, Paris, France. (No. 541,036).

TELEPHONE TRANSMITTER. Charles Clamond, Paris, France. (No. 541,037).

Street Railway Notes.

It is reported that an electric railway will be built between Ashland and Mexico, Mo., passing through Englewood.

The Brott Electric Bicycle Co., Washington, D. C., has changed its name to the Brott Rapid Transit Co., and increased its capital stock to $30,000,000.

It is reported that the property of the Atlanta Traction Co., Atlanta, Ga., has been sold at auction to a Baltimore syndicate for $150,000.

The Jackson Street Railway Company, Jackson, Mich., will extend its lines to Vandercook's Lake, at a cost of $35,000.

There is talk of connecting Waterloo and Cedar Falls, Iowa, by an electric railroad.

New Corporations.

The Woodward Water, Heat and Power Company, Woodward, Okla., by A. G. Cunningham, John M. Pugh. Capital stock, $25,000.

The Coraopolis, Sewickley and Economy Electric Street Railway, Beaver Falls, Pa., by W. D. Tredway and others. Capital stock, $150,000.

The Moundsville, Benwood and Wheeling Railway Company, Moundsville, W. Va., by J. W. Burchinal, M. F. Cox and others. Capital stock, $250,000.

The Dallas City Street Railway Company, Dallas, Tex., by Frank P. Clark, of Baltimore; J. L. Sale, of Dallas, and others. Capital stock, $500,000.

The North Trumbull Rapid Transit Company, Warren, Ohio, has been formed, to build a passenger and freight electric railroad from Farmdale to Mesopotamia, a distance of twenty miles.

The Southern Electric Development Company, Atlanta, Ga., by Robt. Robinson, Robert F. Shedden, and J. H. Gilbert. Capital stock, $10,000.

Trumansburg Electric Light Company, Trumansburg, N. Y., by C. C. Sears, A. S. Mosher and others. Capital stock, $10,000.

Dallas Street Railway Company, Dallas, Tex., by F. P. Clark, of Baltimore, G. L Blackwood, of Denison, and J. L. Salle. Capital stock, $500,000.

Hammond Lighting Company, Chicago, Ill., by William B. Engel, C. F. Griffin, and M. E. Barnhart. Capital stock, $210,000.

The Little Rock Traction and Electric Company, Boston, Mass., has been organized with Allen N. Johnson, president; George B. Rose, secretary, and Charles F. Pennel, treasurer. It is composed principally of the United Electric Securities Company, of Boston, and the General Electric Company, of New York, and St. Louis local companies. It will control all of the street railway lines of the city of Little Rock.

Bridgeton & Harrison Electric Company, Bridgeton, Me., G. P. Locke, of Norway, president; C. H. Scribner, of Bridgeton, treasurer. Capital stock, $10,000.

F. F. Becker, Brook Haven, Miss., has, with others, organized a joint stock improvement company, with a capital stock of $200,000, to establish an electric light plant, etc.

Little Falls Street Railway Company, Little Falls, N. Y., by William H. Tylee, of Worcester, Mass., M. E Gregory, of Corning. Capital stock, $75,000.

Possible Contracts.

An electric light plant is to be established in Boone, Ia.

Miles City, Mont., will issue bonds with which to purchase the electric light and water-works plant now owned by a private corporation.

Alexander City, Ala., is to have an electric light plant.

Bids are invited by the village trustees of Phelps, N. Y., for the erection of an electric light plant to cost about $35,000.

The Warfield Mfg. Co., Baltimore, Md., has received the contract to light Ocean City, Md., by electricity.

George L. Campbell, Columbia, Ala., is in a position to give information concerning the establishment of an electric light plant in that place.

The Southern Electric Service Co., Norfolk, Va., is after a franchise to construct underground conduits for the telephone service in that city.

Trade Notes.

The Western Electric Co., of New York and Chicago, has secured the contract for the wiring, etc., in the new addition to the Metropolitan Life Insurance Building, Madison avenue and 23d street, New York.

Charles D. Mosher, manufacturer of the Mosher steam separator and grease extractor, No. 1 Broadway, New York, has published a treatise on The Steam Separator; its Object, Action and Application. Copies can be had free on application.

As high grade manufacturers the Harrisburg Foundry and Machine Works, of Harrisburg, Pa., have gained a well deserved position in the engine and boiler world, and it will be to the direct advantage of all buyers to make themselves familiar with their fine types of engines and boilers.

The Law Battery Co., 39 and 41 Cortlandt street, New York, has just issued an illustrated catalogue of its celebrated battery. "The Law double cylinder cell, known as 'Old Reliable' hits the mark every time." The catalogue is divided into two parts—part 1 relating to general trade; part 2 to electro-therapeutics.

W. R Ostrander & Co., 204 Fulton street, New York, have just issued their revised catalogue, 10th edition. The catalogue is very complete and fully illustrated. This company is well known all over North America as manufacturers of patented electric bell goods, electric light material, telegraph and telephone goods and general electrical supplies. Also speaking-tube hardware, bell-hangers' hardware and pneumatic call bells.

The Ball & Wood Co., 15 Cortlandt street, New York, have received the contract for the installation of a number of their well-known engines in the new station of the Edison Electric Illuminating Co., Paterson, N. J. The equipment will consist of five of their new type of vertical engine, 600-H. P. each, two of the same type of 700-H. P. each and one of 300-H. P. This station is expected to be a model one in all respects, and for many months the officers of the company have been gradually working up the details and investigating appliances.

J. Jones & Son, manufacturing electricians and dealers in electrical supplies of all kinds, 67 Cortlandt street, have just completed their stock taking for their fiscal year, and report having done 40 per cent. more business than during the year previous. In fan motors alone they are selling twice as many as last season. They keep a large stock of stationary fan and power motors, and ceiling fan motors of several designs, for direct and alternating current. The firm has a stock of direct-current Lundell ceiling fan motors which will be disposed of at a sacrifice. J. Jones & Son are agents for the Bates ceiling fan-motors, also the Fontaine Crossing Electric Co.'s dynamos and motors.

WOVEN WIRE BRUSHES.

The Belknap Motor Co., of Portland, Maine, are the patentees and manufacturers of the best woven wire commutator brush on the market.

ELECTRICAL and STREET RAILWAY PATENTS

Issued June 11, 1895.

540,620. Electric Circuit William W. Alexander, Kansas City, Mo., assignor to the Gill-Alexander Electric Manufacturing Company, same place. Filed Mar. 24, 1890.

540,632. Car-Fender. Edwin M. Carhart, Providence, R. I. Filed Oct. 5, 1894.

(*Continued on next page.*)

National Electric Light and Street Railway Associations.

NATIONAL ELECTRIC LIGHT ASSOCIATION.

President, C. H. Wilmerding, Chicago, Ill.; 1st Vice-President, Frederic Nicholls, Toronto, Canada; 2d Vice-President, E. F. Peck, Brooklyn, N. Y.

Members of Executive Committee: E. H. Davis, Williamsport, Pa, (one year); W. R. Gardiner, Pittsfield, Mass.; George A. Redman, Rochester, N. Y.; J. J. Burleigh, Camden, N. J Next meeting, New York, May or June, 1896.

AMERICAN STREET RAILWAY ASSOCIATION.

Next meeting, Montreal, Que., October, 16, 17 and 18, 1895.

President, Joel Hurt, Atlanta, Ga.; Vice-President, W. Worth Bean, St., Joseph, Mich.; 2d Vice-President, John M. Cunningham, Boston, Mass.; 3d Vice-President, Russell B. Harrison, Terre Haute, Ind., Secretary and Treasurer, William J. Richardson, Brooklyn, N. Y.; Executive Committee, Henry C. Payne, Milwaukee, Wis.; W. H. Jackson, Nashville, Tenn.; D. G. Hamilton, St. Louis, Mo., C. C. Cunningham, Montreal, Canada; J. N. Partridge, Brooklyn, N. Y.

NEW YORK STATE STREET RAILWAY ASSOCIATION.

Next meeting, Albany, N. Y., third Tuesday in September, 1895.

President, G. Tracy Rogers, Binghamton; First Vice-President, John H. Moffitt, Syracuse; Second Vice-President, W. W. Cole, Elmira; Secretary and Treasurer, William J. Richardson; Brooklyn; Executive Committee, D. B. Hasbrouck, New York; John N. Beckley, Rochester; Daniel F. Lewis, Brooklyn.

OHIO STATE TRAMWAY ASSOCIATION.

Next meeting, fourth Wednesday in September, 1895.

President, Albion E. Lang, Toledo; Vice-President, W. J. Kelly, Columbus; Secretary and Treasurer, J. B. Hanna, Cleveland; Chairman Executive Committee, W. A. Lynch, Canton.

MASSACHUSETTS STATE STREET RAILWAY ASSOCIATION.

President, T. H. Cunningham, Boston; Secretary and Treasurer, A. S. Butler, Lawrence; Executive Committee, Samuel Winslow, Alfred A. Glazier, Boston; P. F. Sullivan, Lowell; E. C. Foster, Revere; Horace B. Rogers, Brockton; A. E. Smith, Springfield; Prentiss Cummings, Boston.

THE TEXAS STREET RAILWAY ASSOCIATION.

President, W. H. Sinclair, Galveston; vice-president, C. A. McKinney, Houston; Secretary and Treasurer, C L. Wakefield, Dallas. Directory: The officers and W. H. Weiss, San Antonio and George B. Hendricks, Fort Worth.

Next meeting, Galveston, third Wednesday in March, 1896.

PENNSYLVANIA STATE STREET RAILWAY ASSOCIATION.

Next meeting, first Wednesday in September, 1895.

President, John A. Rigg, Reading; First Vice-President, Robert E. Wright; Secretary, S. P. Light, Lebanon; Treasurer, W. H. Lanius, York.

THE MAINE STREET RAILWAY ASSOCIATION.

President, W. R. Wood, Portland; Secretary and Treasurer, E. A. Newman Portland; Executive Committee, W. R. Wood, Portland; George E. Macomber, Augusta; F. M. Laughton, Bangor; Frank W. Dana, Lewiston; Amos F. Gerald, Fairfield.

MICHIGAN STATE STREET RAILWAY ASSOCIATION.

President, W. L. Jenks, Port Huron; Vice-President, W. Worth Bean, St. Joseph; Secretary and Treasurer, B. S. Hanchett, Jr., Grand Rapids; Executive Committee, the Officers and David H. Jerome, Saginaw, and Strathern Hendrie, Detroit.

THE STREET RAILWAY ASSOCIATION OF THE STATE OF NEW JERSEY.

President, Thos. C. Barr, Newark; Vice-President, W. S. Scull, Camden; Secretary and Treasurer, Charles Y. Bamford, Trenton; Executive Committee, Officers and C. B. Thurston, Jersey City; H. Romaine, Paterson S. B. Dod, Hoboken.

540,641. Railway-Signal. William Daves, Jersey City, assignor of one-half to William H. Peddle, Roselle, N. J. Filed Dec. 29, 1894.

540,644. Fender Attachment for Street-Cars. Eliseo Del Valle, Brooklyn, N. Y., assignor of one-half to Augustus R. O. Schabbehar, same place. Filed Aug. 2, 1894.

540,653. Supply System for Electric Railways. Oscar A Enholm, New York, N. Y., assignor, by mesne assignments to the Electro-Magnetic Traction Company, Washington, D. C. Filed Nov. 3, 1891.

540,664. Electric Railway. Sebastine Hoeninger, Milwaukee, Wis. Filed Aug. 15, 1894.

540,665. Fare-Receiver. Stephen C. Houghton, San Francisco, Cal. Filed Aug. 18, 1894.

540,668. Regulation of Alternating Generators. Rudolph M. Hunter, Philadelphia, Pa. Filed June 21, 1894.

540,685. Electric Brake. William B. Potter, Schenectady, N. Y., assignor to the General Electric Company, of New York. Filed Mar. 9, 1895.

540,733. Fender for Cars. Ernest Gerstenberg and Herman Barghausen, Washington, D. C. Filed Nov. 22, 1894.

540,742. Illuminated Sign or Display. Peter F. Keelyn, Milwaukee, Wis. Filed Jan. 18, 1895.

540,761. Telephone. Walter W. Scott, Buffalo, N. Y. Filed Mar. 4, 1895.

540,772. Photo-Telegraph. Charles Willoughby, San Francisco, Cal. Filed Nov. 3, 1894.

540,781. Telephone-Transmitter. Daniel Drawbaugh, Eberly's Mill, Pa., assignor to the Drawbaugh Telephone and Telegraph Company, New York, N. Y. Filed Feb. 16, 1895.

540,799. Cross Bar for Telegraph Poles. James B. Oliver, Shield's Station, Pa. Filed Aug. 10, 1894.

540,800. Electric-Arc Lamp. Samuel P. Parmly, Chicago, Ill. Filed Oct. 26, 1891.

540,830. Safety Apparatus for Street-Cars. August Fischer, Chicago, Ill., assignor of one-half to Johann G. Eggers, same place. Filed Feb. 26, 1895.

540,859. Electric Railroad-Signal. Burton H. Gedge, Anderson, Ind. Filed May 20, 1892.

540,867. Life-Guard for Street-Cars. Wahlfrid A. Nelson, New York, N. Y. Filed Dec. 5, 1894.

540,883. Trolley. William E. Steinbach, Philadelphia, Pa. Filed Apr. 6, 1895.

540,900. Conduit Electric Railway. David Brooks, Jr., Philadelphia, Pa. Filed June 9, 1892. Renewed Dec. 7, 1894.

540,901. Conduit-Railway Conductor. David Brooks, Jr., Philadelphia, Pa. Filed Feb. 27, 1892. Renewed Dec. 8, 1894.

540,959. Telephone-Transmitter. Daniel Drawbaugh, Eberly's Mill, assignor to G. Milton Blair, Hanover, and Calvin W. Ream, Reading, Pa. Filed Feb. 23, 1895.

540,960. Carbon-Holder for Telephones. Daniel Drawbaugh, Eberly's Mill, assignor to G. Milton Bair, Hanover, and Calvin W. Ream, Reading, Pa. Filed Feb. 21, 1895.

540,961. Telephone-Electrode. Daniel Drawbaugh, Eberly's Mill, assignor to G. Milton Bair, Hanover, and Calvin W. Ream, Reading, Pa. Filed Feb. 21, 1895.

540,969. Telephone. Stephen D. Field, Stockbridge, assignor to the American Bell Telephone Company, Boston, Mass Filed Dec. 5, 1894.

540,973. Car-Fender. Thomas W. Gilmer, Lynchburg, Va., assignor of one-half to James D. Tate, same place. Filed Apr. 17, 1895.

540 974. Multiplex Telegraphy. Daniel B. Grandy, St. Louis, Mo. Filed Dec. 17, 1894.

540,999. Electrically-Driven Fan. Henry G. Morris, Philadelphia, Pa. Filed Feb. 9, 1894.

541,019. Electric-Wire Lock and Support. Daniel W. Smith, St. Louis, Mo., assignor, by direct and mesne assignments, of two-thirds to Alfred Bevis and Charles H. Longstreth, same place. Filed S pt. 10, 1894.

541,020. Conduit Electric Railway. Daniel W. Smith, St. Louis, Mo., assignor, by direct and mesne assignments, of two-thirds to Alfred Bevis and Charles H. Longstreth, same place. Filed Sept. 10, 1894.

541,024. Electromagnetic Combination-Lock. Emory Stockwell and Herbert C. Stockwell, Stamford, Conn., assignors to The Yale & Towne Manufacturing Company, same place. Filed Aug. 6, 1894.

541,031. Illuminated Advertising Sign for Cars James M. Allison, Indianapolis, Ind. Filed Feb. 23, 1895.

541,036. Telephone-Transmitter. Charles Clamond, Paris, France, assignor to the Clamond Telephone Company, Philadelphia, Pa. Filed Mar. 20, 1895.

541,037. Telephone-Transmitter. Charles Clamond, Paris, France, assignor to the Clamond Telephone Company, Philadelphia, Pa Filed Mar. 20, 1895.

541,044. Trolley Wheel and Yoke. William H. Fritz, Dayton, Ohio, assignor of two-thirds to Orlando P. McCabe and George R. Decker, same place. Filed Mar. 12, 1895.

ELECTRICAL AGE

Vol. XV., No. 26. NEW YORK, JUNE 29, 1895. Whole No. 424

Established 1883.

Entered at New York P. O. as second-class matter, January 18, 1891.

THE ELECTRICAL AGE PUBLISHING CO., Publisher

TERMS OF SUBSCRIPTION:

One Copy, one year,	$3.00
One Copy, six months,	1.50
Great Britain and other Countries,	4.00

Cable Address (all Cables,) "Electage," New York.

W. T. HUNT, President. F. N. BASSETT, Vice-President.

T. R. TALTAVALL, Secretary and Editor.

NEWTON HARRISON, E. E., Scientific Editor.

Canadian Representative, E. W. SAYER, Montreal, Que.

ADDRESS ALL COMMUNICATIONS TO

THE ELECTRICAL AGE PUBLISHING COMPANY,

First Floor, World Building.

NEW YORK.

NEW YORK, JUNE 29, 1895.

CONTENTS.

DOES ELECTRIC SHOCK KILL?

A remarkable case of resuscitation from a heavy electric shock is reported from Rochester, N. Y. On the night of June 20 the foreman of the station of the Rochester Gas and Electric Company, at the lower Genesee Falls, received through his body a 3,000-volt current. The man to all appearances was instantly rendered lifeless, but happily, through the forethought and prompt action of three other workmen, the unfortunate man's vitality was restored by the D'Arsonval method of resuscitation. It is freely admitted that the restoration of the man's life was due primarily to the wisdom and persistent energy of his co-laborers, and the success that attended their efforts is a great vindication for the D'Arsonval doctrine. The success attending this case in Rochester will no doubt turn attention to the question of executing convicted murderers by electricity. Many scientists, D'Arsonval among them, claim that electric shock does not under ordinary circumstances kill, and that, in most instances, victims of accidents of this nature can be brought back to life by the practice adopted in drowning cases. There are several instances on record where men, apparently killed by electric shock, have been revived, and as these cases multiply the question as to whether electrically-executed murderers are really killed or not by shock, becomes a very important and serious one. The subject is yet, no doubt, little understood, and the government authorities would do well to make a thorough scientific investigation into the matter.

AN EASTERN INDEPENDENT TELEPHONE ASSOCIATION.

There is some talk of organizing an association of independent telephone companies and telephone manufacturers in the East, for mutual benefit. This proposed action is due to the failure of the National Independent Telephone Company, just organized in Pittsburgh, to grant eastern telephone interests as strong a voice in the affairs of the new association as the representatives from that section thought they should have.

THE HEAT OF THE SUN AS POWER.

If the coal mines of the world were exhausted it would be a relief to know that other great sources of power are at our command; that no distress would ensue with such rapidity as to deprive us of a means of warmth. In fact, our own mother country, England, has been contemplating the time when her fuel centres will have become diminished and the burrowed catacombs reaching far out beneath the ocean's bed will have been emptied of their precious deposits Then the miner will take his pick and shovel and mount upward to the air and glistening sunlight. It will not be a useless errand to move toward the sun's light, because it is here, if all other resources fail, that we may look for greater power and wider possibilities It is not the buried sunlight of the past ages that we need look for any more, for that is forever gone. The heat of the sun, the living, reviving rays of our parent planet will yield its energy for countless years to come, to warm our bodies and light our homes. John Ericson invented a machine with which he believed we would be independent of the coal supply, and make direct use of the heat rays of the sun. It might have been called a sun steam-engine – a steam-engine heated by sunlight. The vast tracts of the Sahara or the deserts of Asia can supply heat that would generate millions of horse power in Ericson's solar engines. The torrent of Niagara is not comparable to the incalculable waste of power on the scorching surface of these enormous plains. The engineering schemes of today will fade into insignificance in comparison with those that the fierce cry of future necessity will force men to execute. It would be a curious sight to see a fully equipped power-station situated in the centre of a dreary waste, sending its thread-like lines across the desert to heat and light some distant town, thus guiding the warm sunlight that it may glow and glitter in the mosques and minarets of the far East.

ELECTRIC POWER IN THE BALDWIN LOCOMOTIVE WORKS.

The economy of electric power for driving tools in factories and machine shops has now been demonstrated to the satisfaction of the most skeptical, and since all barriers to the triumphal advance of electricity have been entirely broken down, we are not surprised to hear of the complete subjugation of conservative ideas to the great force that is "still in its infancy." In many cases it was a hard lesson to learn, but facts could not be subdued by conservatism. The superiority of the new power asserted itself in spite of the opposition from those who were inclined to look upon it as unsubstantial and short lived; and therefore they dismissed it from their minds with a sneer. The "infant" electricity has grown to such large proportions that it promises to be master of the world, and it is conquering all opposing forces with resistless power.

We have from time to time recorded the installation of electric power in various factories and works for the operation of machinery. One of the most interesting of recent installations of this character is that at the Baldwin Locomotive Works, in Philadelphia. Many of the machine tools are now run by electric power, the aggregate of which amounts to exactly one half of that required under the old belt and countershaft system.

The introduction of the electric system in these works was preceded by the substitution of 250 h. p. of Westinghouse engines for the 500 h. p. machine formerly used —a saving at the very start of at least 50 per cent.

The electric motors used in the Baldwin works are those of the Gibbs Electric Company, Milwaukee, Wis. The frame and field magnets of the machine are shown in one of the accompanying illustrations. The armature is of the Gramme ring type, the machine having four poles. The bearings of these motors are of the ball and socket type and are self-oiling. The frame is constructed of two pieces, rabbeted and firmly bolted together, giving a practically unbroken magnetic circuit.

The brush holders possess some novel features which insure cool running and durability of the commutator. Machines up to 9-K. W. capacity have fixed brushes, their design being so excellent that no sparking occurs under any condition of load.

The armature is so designed as to provide abundant radiating surface; in no case does its temperature rise to more than 86° F. above that of the surrounding atmosphere. It is insulated in the best possible manner, and in the final shop tests is subjected to a strain of 1,500-volt alternating current

These machines, the "M" type, vary in speed from 1,150 revolutions per minute for the 400-pound, 2-K. W., 2-horse power motor to 950 revolutions for the 1,540 pound, 9-K. W., 10 horse-power machine. Between these two sizes there are three others, of 3, 4 and 6½ horse-power.

Figure 1 is a general view of the Baldwin wheel lathe room, showing a 10 ton Sellers overhead travelling electric crane. So much shafting was displaced in this room by the electric motors that it is said that the increase of light coming through the skylight upon the work is very marked.

In Fig. 2 is shown the application of a Gibbs motor to a

FIG. I—GENERAL VIEW WHEEL LATHE ROOM, BALDWIN LOCOMOTIVE WORKS.

wheel lathe, the power being transmitted by means of countershafting. The motor stands on two wrought-iron brackets bolted to the uprights of the countershaft frames.

A large Baldwin quartering machine operated by an electric motor is shown in Fig. 3. This is a massive tool, the bed alone weighing 35 tons. It represents the best and latest practice in locomotive tool building.

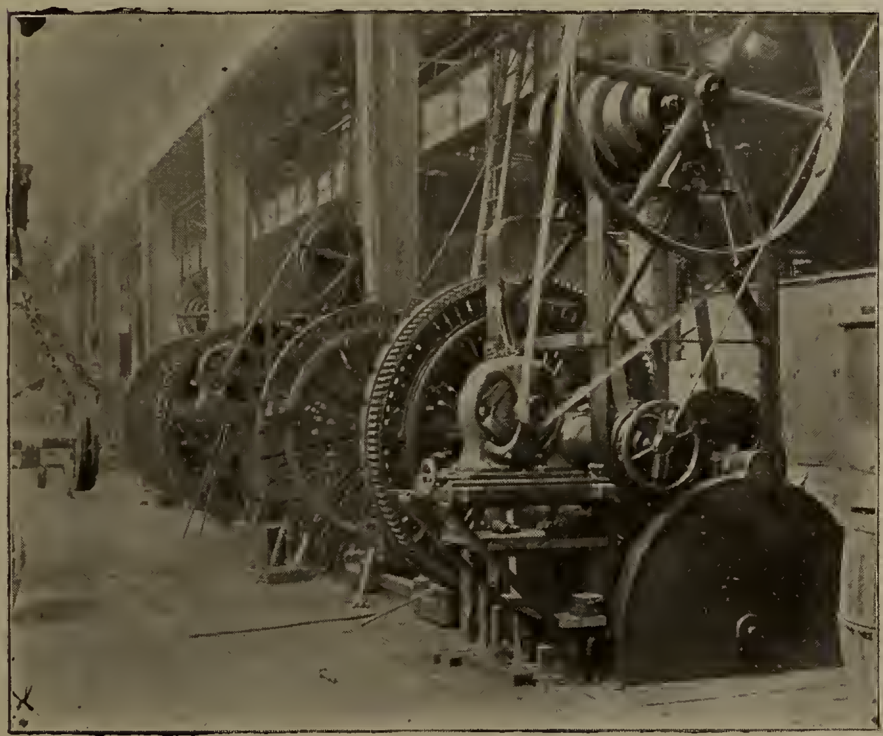


FIG. 2—GIBBS MOTOR OPERATING WHEEL LATHE.

Figure 4 shows the frame and magnets of the Gibbs multipolar motor.

It is stated that in this installation there has been a decided gain in output, due to the perfect readiness of the electric motor to operate at all times and to the more delicately suitable speeds, which can be had through independent motor driving. The other main advantages already experienced are low power cost, increased efficiency, improved light and acceptability to the workmen. These are indisputable facts and well worth the careful

FIG. 3—QUARTERING MACHINE.

consideration of all users of power for stationary machines.

We are indebted to the *American Machinist*, of New York, for the illustrations and many of the facts used in this article.

JOULE'S LAW—The heat developed in a conductor by an electric current passing through it varies as the conductor's resistance, the square of the current's strength, and the time the current lasts.

RECEIVED 3000 VOLTS AND WAS AFTERWARDS RESUSCITATED.

A dispatch from Rochester, N. Y., states that Frank E. Grover, foreman of the Rochester Gas and Electric Company, on the evening of June 20, received a shock from a 3,000-volt current, and was resuscitated from apparent death after 75 minutes' hard work. Life was restored by D'Arsonval's artificial respiration method.

Grover, it is thought, received the full strength of the current at the brushes, but just how the accident happened he does not seem to be able to satisfactorily explain. "All I remember," he said, after he was revived, "is that I was standing near one of the dynamos, and the next moment I thought I was an angel."

Immediately after the accident the other attendants in the station who had practiced the D'Arsonval method of resuscitation, went to work on the victim to produce artificial respiration. This is done by raising and lowering the arms in rhythm, and at the same time alternately pressing and releasing the chest. The workmen persevered in their efforts until a doctor reached the station. The doctor ordered the treatment continued, and shortly after his arrival, about an hour after the accident occurred, Grover

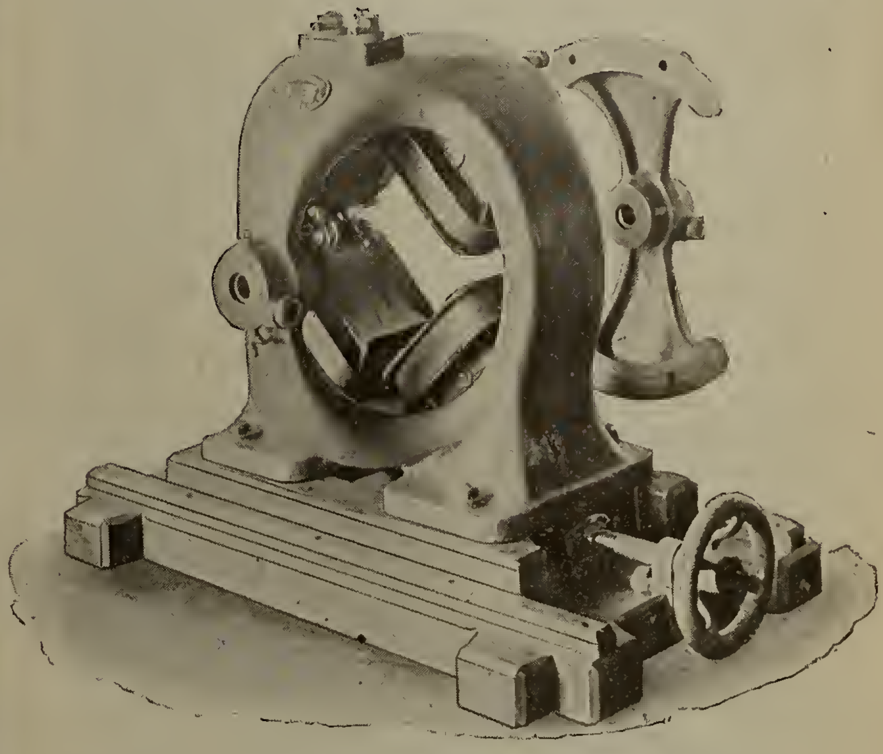


FIG. 4—FRAME AND MAGNETS, GIBBS MOTOR.

began to show signs of returning vitality. A few minutes later natural respiration set in and the victim returned to consciousness. He was then taken to his home where, at last reports, he was out of danger and doing well.

Among some there seems to be a doubt that Grover received 3,000 volts, yet he said himself that he must have accidentally touched the two brushes of the machine, which was an arc-lighter. All agree, however, that the man would undoubtedly have died had not artificial respiration been resorted to.

We have received a letter from Mr. G. A Redman, superintendent of the Brush Electric Light Co, Rochester, N. Y., in which that gentleman states that the resuscitation of Grover was accomplished by three of their workmen—William Julien, W. Ziegler and Ernest Roth. In their praiseworthy undertaking the men followed the instructions laid down by D'Arsonval. "The man had commenced to revive," says Mr. Redman, "when the physician arrived."

PROVIDENCE, R. I.—The fire-alarm, police signal and other electrical wires operated by the City of Providence, R. I., will be laid in the telephone company's conduit. Thirty thousand dollars have been appropriated by the city to defray the cost of this work.

—The simple chemical consumption of 33 grammes of zinc in a battery produces 18,682 units of heat.

PRINCIPLES OF DYNAMO DESIGN.

BY

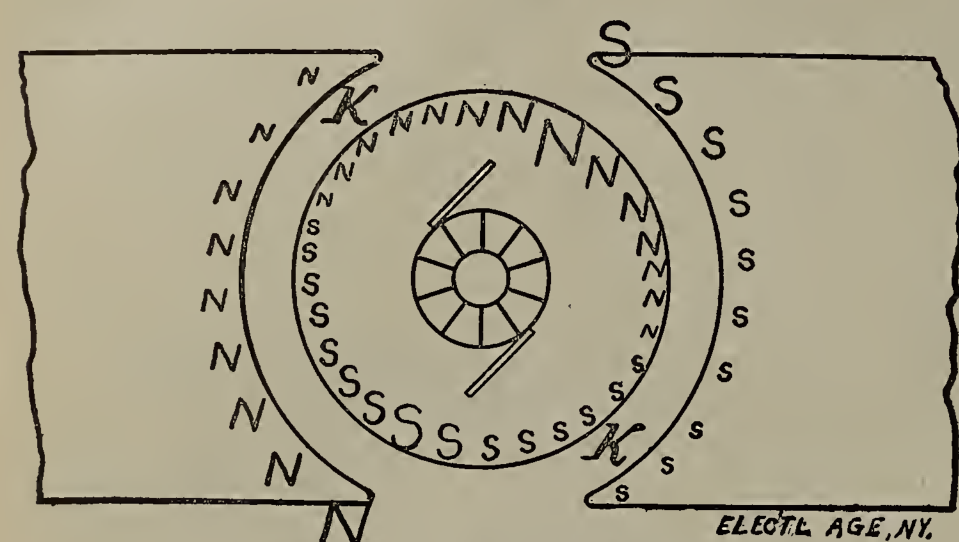
Newton Harrison E.E.

(*Continued from Page* 353.)

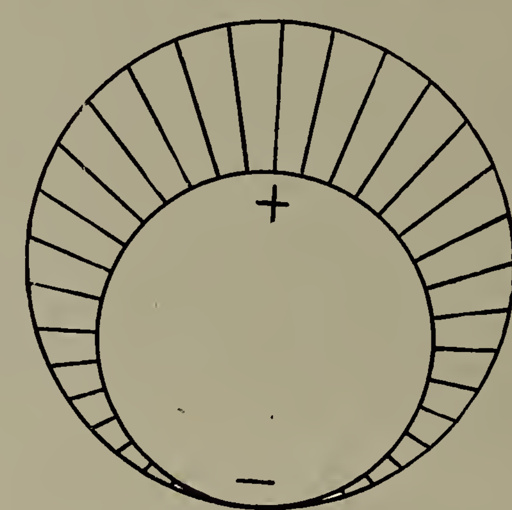
DISTORTION OF FIELD.

The coils of an armature do not develop equal electromotive forces. It is possible to draw a curve showing the distribution of pressure around the commutator as collected from the individual coils. The theoretical growth of E.M.F. is very different from that actually obtained in practice. There are many adjunct circumstances which cause this difference ; if the field were perfectly uniform and unlikely to become distorted, the current would be produced in strict accordance with the laws already stated. But the fact that the very presence of current in the armature enables it to react like any other electromagnet upon the field, immediately produces a factor of the greatest importance, as regards its effect upon the field developed and therefore the E M.F.

A practical way of considering the subject is to examine the illustration below. From the sketch it may be observed that the lines of force appear to be heaped together in equal quantities at points diametrically opposite, and their respective densities are indicated by the varying sizes of the letters. The armature within is similarly delineated and shows that the points K, K, where the field is weakest, is in perfect line with the points of commutation upon which the brushes are pressing. Dobrowolsky has outlined a method for predetermining the position of the brushes if the magnetomotive forces of the armature and field are known. He draws a parallelogram, one side of which represents the M.M.F. of the armature and the other the M.M.F. of the field. The diagonal drawn then represents the position of the brushes on the commutator. If instead of taking the magnetomotive forces into consideration, lines of force are considered instead, and such lines of force in number as actually issue from both field and armature and pass through the same path, then the diagram would be of greater consequence, because there are machines in the market today whose magnetomotive force on armature and field are nearly equal, and whose angle of commutation deviates not more than 10 to 20 degrees from the ideal position, while according to the generally accepted idea the angle should be 45 degrees. The great necessity for properly considering the uniformity of the field, and trying to preserve it, is easily realized when it is known that at least 50 per cent. of the worst difficulties in regulation arise from its distortion.



EFFECT OF ARMATURE REACTION.



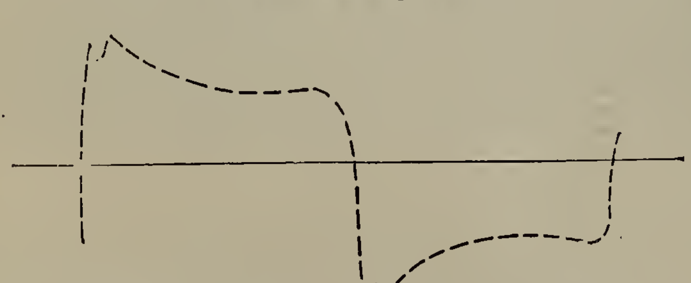
POTENTIAL AROUND COMMUTATOR.

A curve has been shown descriptive of the rise and fall of E.M.F. as determined by the law of the sine wave. This like all other curves based upon the absence of disturbing causes, is but an ideal representation.

Not only do these troublesome factors exist, but they must exist, and at all times exercise their negative effect upon the general output of the machine.

The reaction from the armature cannot be eliminated, neither can the induction within its coils or sundry other smaller troubles of a less important nature. Below is shown a curve which may be compared with the sine curve as showing the difference between the real and the ideal; it has been taken from an arc dynamo, and by its irregularities and sudden rise in pressure shows the distribution of the lines of force, their gradual decrease and abrupt termination. These variations in pressure and eccentricities of growth are illustrative of internal inductive effects as well as distortion of field.

Prof. Ryan, of Cornell University, has made many important investigations under the title of armature reaction, which is but another name for the seat of field distortion. He proposes to reduce the effect of the armature M.M.F. by placing coils around the armature, but situated in the pole-pieces, with the object of having these coils react upon the effective coils in the armature producing the distortion. This would leave the field of the value calculated for in the beginning. It would be an immense advantage to produce an E.M.F. of a gradual and uniform growth, and it would add largely to the usefulness of the machine if the difficulties due to armature reaction were successfully removed.



MODIFIED SINE CURVE OF ARC-LIGHT MACHINE.

HORIZONTAL DEVELOPMENT OF POTENTIAL AROUND COMMUTATOR.

The distribution of E.M.F. as developed in the coils of a perfect dynamo and taken from the commutator would be as represented in the sketch. The potential rises from the zero point until at the upper point of the curve it attains its maximum and then decreases again to zero at the negative brush. By plotting this curve out on a horizontal line a diagram of the different potentials is obtained and the angular differences between the coils when different electromotive forces are being produced. The very slow ascent at the beginning and slow descent at the end of the curve indicates the lack of effectiveness which the coils possess in the vicinity of the neutral space. Efforts have been made to bridge over the coils lying in

that neigborhood by short-circuiting them as they enter into it, but this only induces sparking and other difficulties. Were the lines of forces made to pass radially into the armature at all points the E.M.F. would be developed at a much higher value, so that the curve of commutated potentials would be almost entirely equal to that shown by the highest point of the curve.

If one brush remains stationary and the other be slowly moved around the commutator, the gradual rise of potential can be indicated and plotted very successfully. Each coil would then add its additional E.M.F. to the brush and enable you to represent the exact number of volts generated by coils in different portions of the field.

The method of M. Joubert is described in the *Annales de l'Ecole Normale* of 1881. Many other experiments of his in relation to alternating current work have received the greatest attention. The life of a machine is greatest if the troubles which affect its working parts have been reduced to a minimum. This can only be done by the reduction of causes which exercise the most distressing effect upon those parts. The commutator is sensitive to changes which occur in the armature, and its usefulness as a part of the general structure depends upon the absence of sparking while performing its duty.

This again is a condition which devolves upon the armature, and is a direct indication of its proper or efficient action.

(*To be continued*).

STORAGE BATTERIES.*

BY C. F. ANNETT.

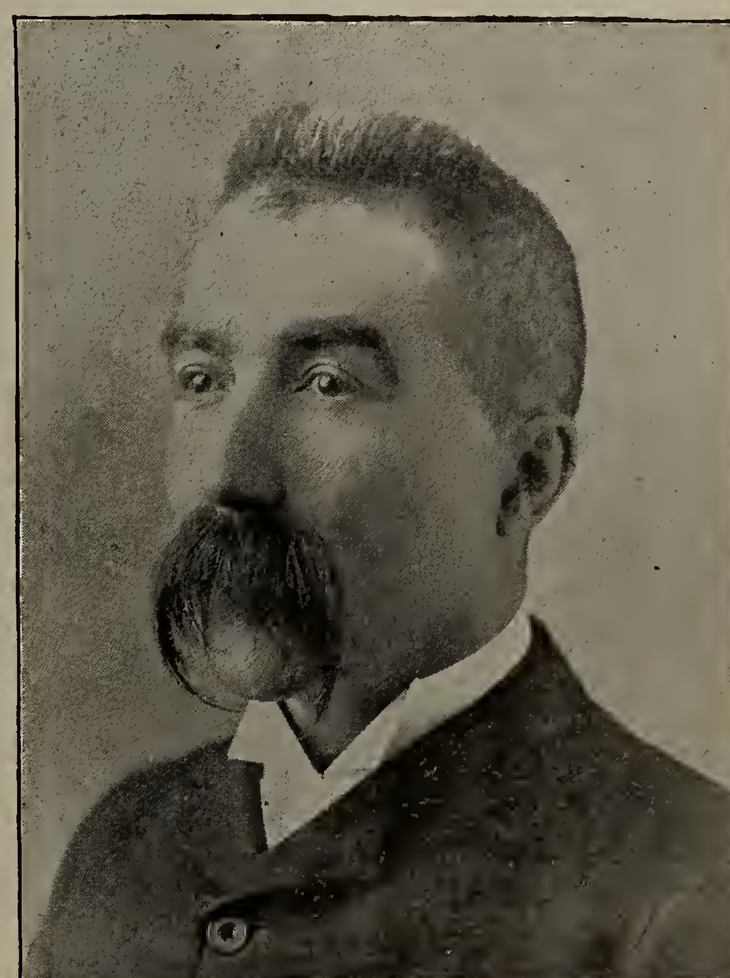
It is well known that the city of Chicago has set its face like adamant against the trolley in the business district, and it required a good deal of subterranean work on the part of the street car companies to secure the privilege of converting their horse-car lines in the residence district to the trolley. The pressure is now very great to get the trolley lines into the heart of the city, but the indications are that it will not succeed. It is said that one of the electrical companies is preparing a plan for storage battery tenders, to be picked up by the trolley cars when they arrive at the end of their overhead lines, which will furnish them with current for the run into the business district and back. I do not know how authentic this information is, and naturally the scheme will not be made public until the efforts now being made to extend the trolley wires have proved abortive, but there seems no good reason why it should not be entirely satisfactory and furnish a solution of a problem acceptable at once to the companies and to the citizens.

While the day of golden dreams for storage battery companies is past and the patent office is not burdened with applications for patents on batteries with millions in them, as in former years, a few strong companies, proceeding carefully and backing up their promises with substantial performance, are quietly recovering much of the ground which has been lost. The battery of today is far ahead of the battery of ten years ago, and its diminished cost makes it available for many kinds of services from which it has been heretofore excluded. I have recently had some experience with the battery manufactured by the Electric Storage Battery Company, known as the Chloride Accumulator. Heretofore our local instruments in the Chicago office have been operated by Crowfoot batteries, and I assume that in addressing an audience of telegraph men it is superfluous to enlarge upon the infirmities of this old but trying friend. While they filled a long-felt want, they also filled a room which was required for office purposes and demanded perpetual attention. The whole outfit has been displaced by four Chloride Accumulators, which operate twenty sounders and two repeaters in constant use. Two of the batteries are always in use, and the other two are at the same time being charged from the electric light wires in series with the lamps which light the office and operating room. The current absorbed by the charging batteries is not enough to materially affect the light given by the lamps, and as it is furnished by our own lighting plant the cost is hardly sufficient to justify the estimate.

Even if purchased at the usual rate, I do not think it would amount to ten per cent. of the cost of renewing the old Crowfoot batteries So satisfactory has been the service that we are about to equip our phonoplex circuits and, in course of time, we will probably make a similar change at all local offices where a charging current is available. There are, of course, many small offices where no current can be reached, but it is worth considering whether, in view of the superior service of the storage battery, it may not be advisable to send out charged batteries and have them returned when used up.

We were agreeably surprised to find that the cost of the storage batteries was but 50 per cent. more than the primary batteries displaced; a difference which will be more than made up by the saving in renewals, not to mention the saving in time and trouble.

The storage battery is steadily regaining lost ground in



C. F. ANNETT, SUPT. TELEGRAPH, ILLINOIS CENTRAL R. R., CHICAGO

the great field of light and power. The catalogue of the battery company above referred to contains a surprisingly large list of plants installed by it, many of them of great capacity, and no doubt the other battery companies are equally active in securing orders. While most of these plants appear to be isolated ones, several belong to light and power companies, and are apparently giving satisfactory service in competition with the dynamo. I recently had the pleasure of inspecting the fine plant now running at the United States mint in New Orleans. They have 54 cells of 2 volts each with normal discharge of 240 amperes, charging the battery during the day and furnishing 200 sixteen candle-power lights at night. The superintendent informed me that they had already effected a saving in their running expenses of $1,050 since the installation of these batteries, which has been just six months. In conclusion, I think there is no room to doubt that the storage battery will in time take its place side by side with the dynamo as an indispensable adjunct to that machine. While there are many uses to which it can be applied simply as a convenient way of storing power in one place to be used in another, its great function will be as a reservoir for the energy of a machine running steadily with a

* Abstract of paper read at the Convention of the Association of Railway Telegraph Superintendents, Montreal, June 14, 1895.

constant output, from which irregular and constantly varying demands are supplied, and by which a break-down, from which no machine is exempt, will be prevented from cutting off the supply of light and power. Its great advantage in diminishing the amount and cost of the generating apparatus required to supply a given amount of power must, in these days of small margins and close profits, commend it to an enlarged use by central stations as well as isolated points.

THE BERLINER DECISION.

We give herewith the main points of the decision of the United States Court of Appeals in the Berliner Patent case, which decision was briefly referred to in our last issue.

This is a bill in equity, filed February 9, 1893, signed in behalf of the United States by its Attorney-General, against the American Bell Telephone Company and Emile Berliner, containing a prayer in the alternative touching patent issued November 17, 1891, numbered 463,569, to the American Bell Telephone Company as assignee of Berliner. The alternative prayer is, that the patent be in all things recalled, repealed and decreed absolutely null, but that, if the patent is not deserving to be wholly repealed, but is repealable in part, a decree be made repealing only such parts as the court shall deem to be repealable. As to the latter part of this alternative prayer for relief, the court has heard nothing, and there is no occasion to consider it.

Berliner's original application was filed June 4, 1877, and patent 463,569 was issued more than fourteen years thereafter. This patent is sufficiently described for the purposes of this case by saying in a general way that it covers the microphone. In addition to this the American Bell Telephone Company, as assignee of Berliner, holds, or held, a patent issued to Berliner, November 2, 1880, numbered 233,969. It is represented that the patent of November 2, 1880, was a divisional one, growing out of the same original application which supports patent 463,569. It is also represented that this patent covers the invention described and claimed in patent 463,569, under such circumstances that the latter comes within Miller *vs.* Eagle Manufacturing Company, 151 U. S., 186.

The pith of the case, as stated briefly by the counsel for the United States, is:

1. That patent 463,569 is void for illegal delay in its issue, and
2. That it is also void on the ground that the prior patent, 233,969, "was granted upon the same application to the same applicant for the same invention."

Each proposition will be stated hereafter more fully, and in the precise form in which it came to the court.

Berliner having no interest need not be further noticed by us.

The court then quotes extracts from the bill showing the first ground of proceeding the case. Regarding the various allegations as to the delay in the progress of the application before June 9, 1882, the court says: "These we omit because the counsel for the United States now admit that no point is made for that period."

The court then says:

There are also allegations that, prior to acquiring the invention of Berliner, the defendant corporation became the owner of the patent numbered 174,465, issued March 7, 1876, to Alexander Graham Bell, covering the transmission of sound by means of an undulatory current of electricity and the same considered in The Telephone Cases, 126 U. S.; that patent 463,569, if valid, will continue without substantial diminution, during the full term thereof, the same close monopoly of the art of telephoning enjoyed under the patent to Bell; and that this is against justice and equity, and contrary to the plain spirit and intent of the patent laws. These are pointed out as circumstances on which the bill bases an alleged extraordinary duty of the defendant corporation to speed the Berliner application. If it were necessary to examine the motives of the American Bell Telephone Company, as bearing on a question of either positive or implied fraud, or on a question whether it did in fact speed the application of Berliner, and its purposes in relation thereto, these facts might become relevant as evidence, as might also the alleged great value of the microphone. But it is clear that all such allegations are irrelevant to the bill itself So far as the law is concerned, the patent in suit is to be tested independently of the Bell patent. There can be but one law touching alleged delays in the progress of an application through the Patent Office, and touching the duty of applicants with reference thereto, whether the invention was from the outset seen to be valuable, or only afterwards proves to be so, or always remains of little account To deny this is to deny that the laws are equal, and would furnish a standard for the determination of the rights of patentees too fickle and imaginative to form a proper basis for the use of a court of law Therefore we have not set out these allegations as proper proportions of the bill, and do not deem it necessary to make further explanations in reference to them.

Extracts from the answer of the American Bell Telephone Co. are then given to illustrate its defence on this point.

To the answer, says the court, replication was duly filed and proofs taken. The cause was heard in the Circuit Court and there decided in favor of the United States, on each of the points we have briefly stated as being issues in the cause, from which appeal was duly taken to this court.

The bill alleges in portions of it which we have not cited, that Berliner's application was abandoned at one stage of the proceedings. In order to correctly estimate the issue under discussion it is necessary to note that this is not now relied on. The United States has somewhat variously stated its position, and our first duty is to understand precisely what it is.

The United States having thus stated its position, we do not find ourselves required to recite the details of the proofs It is enough to say that the case shows that all the allegations in the answer which we have quoted, are sustained, except only that we do not deem it necessary for the purposes of this case to determine fully the condition of the proofs on the proposition that there rested on the American Bell Telephone Company an extraordinary duty to speed its application by every means known to the law, as alleged in the bill, or to exercise the greatest possible diligence, as claimed at the bar. Unless the case required this extreme diligence, there can be no just claim of an unlawful omission to act; and therefore there could not be the "unlawful purpose," because, as we have said, this does not result from a mere omission to do what the law does not require.

The court then considers the various postponements in the progress of the application through the patent office and continues: It is plain, therefore, the commissioners were at various crucial points personally acquainted with the magnitude of the controversy, and with some of its details. Knowing its magnitude, they knew, at least in a general way, that detriment to the public interests would come from delay in the progress of the case, in the event that it was followed by the issue of the patent. This was all which it was necessary they should know, as it is the pith of the entire complaint of the United States. Having this knowledge, the claim of the United States that the American Bell Telephone Company should have suggested on the record, or anywhere else, that delay in the application was prolonging the monopoly of the microphone, falls, of course, to the ground, unless we accept the extreme proposition that it was the duty of that corporation to keep this fact constantly before the eyes of the commissioner personally.

It is not to be forgotten that among the difficulties which the Bell Telephone Company was forced to face, was the fact that its application was twice rejected, once during the first period named by the United States, and the second, under formidable objections, during the third period.

Returning now to the second period named by the United States, that is to say, from June 9, 1882, until the decision of the Supreme Court in the Spring of 1888 in The Telephone Cases, reported in 126 U. S., we will note at the outset that the report of the commissioner, accepted

by the Attorney-General, to which we have already referred, reduces this period to one from October 23, 1883, to November 16, 1888, a matter of some five years. This, however, is a matter of no consequence, except so far as it is explanatory of some other facts to which we may refer. June 9, 1882, the Drawbaugh application was still pending in the Patent Office. It had been rejected on the ground that the Edison carbon microphone and the Bell telephone had been in use more than two years prior to Drawbaugh's application; but Drawbaugh claimed that this public use was without his consent, and therefore did not affect him. It is also conceded by the United States, as well as claimed by the American Bell Telephone Company, that this rejection of Drawbaugh was not final, because, as said by the United States, "it was still open to him to traverse the fact, and have the question settled by public use proceeding." But it is said by the United States that the Patent Office could easily have disposed of Drawbaugh, because at that time the law was well settled, that under the statute of 1870, two years' public use, even without his consent, was fatal to him; and Manning *vs.* The Cape Ann Isinglass and Glue Company, 108 U. S., 462, is referred to as settling this point. This case was not decided until May 7, 1883. It did not involve this question; and what was said therein touching it was a *dictum*, and was never acquiesced in by Drawbaugh's solicitors. Whether the law can now be regarded as settled, in view of Andrews *vs.* Hovey, U. S, 267, decided November 14, 1887, in consideration that it discusses the act of 1870, now Section 4886 of the Revised Statutes, as well as the act of 1839, we need not consider. The American Bell Telephone Company was compelled, with reference to the progress of this application, to meet the practical condition of things, and we must put ourselves in that position. Therefore, whatever may now be said as to the theoretical side of the law, it is more appropriate to the purposes of this case to observe that Drawbaugh's solicitors did succeed in practically retaining his application under adjudication by the Patent Office until near the close of October, 1891, as already stated.

The events which we have recited give us another opportunity of showing the inability of the United States to furnish a practical rule by which to test the high degree of diligence which they require. On being asked what course was practicable at this period to answer their demands in this direction, they seem uncertain what method should have been adopted. The United States at one point say that the commissioner could have read the evidence in the infringement case, meaning The Telephone Cases, for himself, and decided the question of priority on the facts there shown. Of course, a request of the commissioner to do this, or cause it to be done by any one in the Office, would have been fruitless.

We are satisfied that the statutory provisions touching the Patent Office are *sui generis*, and contain in themselves peculiarities, which render inapplicable certain rules and decisions otherwise of an analogous character.

A further examination of the statute brings out even a more positive conclusion touching this issue. Section 4916 of the Revised Statutes touching re-issues provides that "whenever any patent is inoperative or invalid" * * * * "the commissioner shall" * * * * "cause a new patent" * * * * "to be issued to the patentee," and so on. By the frame of this statute the jurisdiction of the commissioner depends nominally on the fact that the patent is inoperative or invalid. As against alleged infringers, and as between alleged interfering patents, the statute has been strictly construed, so far as the powers of the commissioners are concerned, although we are not aware that any issue touching them has arisen as between the United States and a patentee. With the possible extreme exceptions which we have characterized, the statute vests in the Commissioner of Patents authority to issue all such patents as on examination he deems proper to issue, that none thus issued are issued *ultra vires*, that all such are within the scope of his powers within the meaning of the expressions we have cited from the Supreme Court, and that there is nothing in this case which excepts it from this general rule.

The United States has filed a motion in this court, praying that if we find for the appellants, we will reserve leave to the Circuit Court to permit an amendment at bar, alleging that the American Bell Telephone Company did directly agree with the representatives of the Drawbaugh application that the determination by the Patent Office of the question of priority should abide the decision in The Telephone Cases, that these parties, acting in concert, did procure the Commissioner of Patents to consent to such postponement, and that thus the American Bell Telephone Company, by its own act, procured the postponement of the decision of priority, without necessity or right, in violation of its duty to speed the patent for the microphone. We have already found that, as the record now stands, it contains no proof to sustain an allegation of this character. Therefore, an amendment of this nature would require the opening of the record below for further proofs. It is not at all a case where a complainant has proved his case, but his allegations are found by the appellate court to be inapt. To grant this motion would under the circumstances violate all the rules requiring diligence from parties complainant. The decree of the Circuit Court is reversed, and the case remanded to that court with directions to dismiss the bill.

THE NEW YORK ELECTRICAL SOCIETY.

The annual meeting of this Society was held on the evening of June 18, at the electric power house of the Metropolitan Traction Co., 146th street and Lenox avenue, New York.

The election of officers took place, with the following result:

President, J. W. Lieb, Jr.

Vice-presidents. Herbert Laws Webb, Edward Caldwell, Francis Forbes, Nelson W. Perry, Prof. L. N. Laudy, Prof. Morris Loeb.

Secretary, George H Guy.

Treasurer, Henry A. Sinclair.

The secretary's report says:

"There have been five deaths and eight resignations during the year; 33 members have been elected, and the net increase in membership is 20 The number of members now on the books of the Society is 370.

"Although last year the average attendance showed a marked improvement on the preceding year, during the season just concluded the Society has had most gratifying evidence that its lectures have been on the whole even more thoroughly appreciated than ever. The range of subjects has been wide and in almost every instance the Society has been fortunate in an able and exhaustive treatment of the theme selected. Some of the best lectures promised are still on the programme for next season, and will in all probability be delivered at an early date."

After the meeting the power and car houses were thrown open for the inspection of the members.

F. S. Pearson, chief engineer of the company, and L. J. Hirt, assistant chief engineer, explained the features of the system in detail. In the car house the members were shown the connecting shoe under the cars and its operation was fully explained, a critical examination of its action being made.

Two special cars were run over the line to give the members an opportunity to witness for themselves the practical operation of the road. The run was made down to 125th street and back, and the party was very favorably impressed with the smoothness of operation of the system, and the perfect control of the cars.

Philip Reis.—The German Emperor has directed that an annual pension of 400 marks, about $160, shall be paid to the daughter of Philip Reis, the inventor of the telephone.

REORGANIZATION OF THE BROOKLYN TRACTION CO.

On June 22d public announcement was made of the general plan to reorganize the Brooklyn Traction Co. This plan has been agreed to by the principal stockholders and will be submitted to the board of directors during the present week. The only details in doubt are upon the probable issue of $3,000,000 in preferred stock, and the question as to whether holders of collateral trust notes shall receive for them bonds or money.

In brief, the outline of the plan of reorganization is as follows: The new company will assume the lease and all assets and liabilities of the Long Island Traction Co.; the capital stock will be $20,000,000; the issue of $6,000,000 ten-year 6 per cent. bonds; levying an assessment of 10 per cent. on the stock of the Long Island Traction Co.; the outstanding $1,800,000 collateral trust notes will be taken up on August 6.

It is now stated that Clinton L. Rossiter, superintendent of the Buffalo division of the New York Central and Hudson River Railroad, will be chosen to succeed Daniel F. Lewis as president of the Brooklyn Heights Railroad Co.

PERSONAL.

Mr. Charles F. Pearce, son of Frederick Pearce, the well-known manufacturing electrician, 77 and 79 John street, New York, was, on June 20, married to Miss Anna Elizabeth Ebans, of New York. The ceremony took place at the residence of the bride's parents, on Manhattan avenue.

Mr. and Mrs. Pearce are spending their honeymoon in the White Mountains, and The Electrical Age wishes them a long and happy life.

Mr. Charles F. Pearce graduated from the New York College eight years ago, since which time he has been associated with his father in the business of manufacturing electrical apparatus. He is now assistant foreman of the factory. He supervised the installation of the fire alarm central station apparatus in Newark, N. J., Brooklyn, N. Y., and Boston, Mass., and was highly complimented for the excellent manner in which the work was performed. The Boston plant has been arranged for dynamo current in place of batteries, and is believed to be the first installation of this character using dynamo current.

Mr. Pearce gives every promise of attaining a prominent place in the front ranks of his chosen profession, and the combination of theoretical and practical knowledge which he possesses to a large degree will be a potential factor in the large business with which he is connected.

ELECTRIC POWER ON THE NANTASKET BEACH R. R.

A few weeks ago The Electrical Age, on the authority of President C. P. Clark, of the New York, New Haven & Hartford R. R., announced that the Nantasket Beach branch of that road would be equipped with electric power for the propulsion of trains. The plans of the company have been carried out, and on the night of June 21 a test of the new system was made. According to a despatch from Boston, the trial was eminently satisfactory. A speed of 80 miles an hour is reported to have been attained and the motor was not geared up to its limit.

The start was made at 9 o'clock, and before the motor car had traversed a distance of four times its own length it was running at a speed of 20 miles an hour.

A load test was also made. A load of 175 tons was put on to the motor. The latter started off and increased its speed with such ease that proved that three or four times the load could have been easily drawn.

The construction of the overhead line is said to be of the very best character. The poles on the tangents are in perfect alignment, and were set with the greatest of care.

The poles are set in wooden caissons five feet deep and three feet wide, the space between them and the caissons being filled in with cement concrete. They are placed between the two tracks and sustain cross-arms, from which are suspended the trolley wires. The feeders are also carried along the poles.

The motors were built by the General Electric Company and are made extra strong and heavy in order to secure greater traction. A motor car fully equipped weighs about 60,000 pounds.

A small electric motor operates an air pump, which provides compressed air for the air-brakes and whistle.

This test, which appears to have been a successful one, will no doubt turn the attention of practical railroad men more than ever to the possibilities of electric power for the propulsion of trains in general.

SOUND PRODUCED BY THERMIC RADIATION.

M. Semmola, in *Comptes Rendus*, shows that in causing intermittent solar light to fall, by means of a lens, on the gilded metallic plate, 2 mm. thick, of a Hunnings microphone, the telephone put in circuit produces a slight but very distinct sound. If the luminous ray be suppressed, the sound ceases. The intensity of the sound increases or decreases according as the intermittences of the radiation become more or less rapid. The best radiations are the thermic radiations, as the sound is louder when the metallic plate is coated with smoke-black. On the other hand, the sound is no longer heard when the luminous pencil traverses non-thermal substances before reaching the microphone. It is necessary that the tiny image of the sun which is formed in the focus of the lens, and which strikes the vibrating plate, should be fairly hot and capable of at least carbonizing paper. It seems, then, that the plate suffers rapid and regular dilatations and contractions, which determine the thermic vibrations.

ELECTRIC BATHS FROM STREET CIRCUITS.

It is stated that the employment of street-lighting circuits for electric baths has become quite customary in France. A transformer is used which lowers the potential to from 15 volts to zero. Where only a single bath is to be fitted up, as in a private residence, there is employed a combination in series of a shocking-coil and a small transformer. The whole is placed in a little marble receptacle above the bath. The secondary of the transformer moves along slides, and a rod passing to the outside enables the current to be regulated from a maximum to a minimum strength. The primary circuit is provided with an interrupter. The wires of the secondary proceed directly to the electrodes, which are simple plates of metal that can be placed anywhere in the bath by means of suspending hooks. There is also added an ampere-meter for continuous and alternating currents.

NEW ELECTRICAL JOURNAL.

A new electrical paper, "*The Electrical Journal*," has made its appearance in Chicago. It is published semi-monthly by The Electrical Journal Publishing Co., of which John P. Barrett is president. The main purpose of the new paper is, we understand, to directly reach the members of the National School of Electricity, and the *Journal* is to be educational in character. Dr. J. Allen Hornsby is editor-in-chief. *The Electrical Journal* is the size of The Electrical Age.

—A plant of chloride accumulators will probably be installed in the new Court House and City Hall, Minneapolis, Minn.

REMEDIES FOR DISTURBING OR INTERFERING CURRENTS ON TELEGRAPH AND TELEPHONE CIRCUITS.*

BY THOMAS D. LOCKWOOD.

Let us consider the most common disease, and the one easiest to cure. It is surface leakage or conduction between different wires attached to the same common supports. It is by telegraph men—by city telegraph-trouble men, at all events—called "weather-cross," because it only appears in damp or wet weather, and because it has all the effects of a cross.

All of the above names are merely aliases under which it masquerades, and its real name is "Defective Insulation."

One way of diminishing its effects has been patented four times, twice in England and twice in the United States, and has largely been used in both countries. This is to provide each cross-arm with stapled conducting wires running near to each insulator, and all connected at the pole to an earth wire running down the pole and buried under it, or at its foot; if it is difficult to obtain good earth at any pole, the cross-arm wires can be attached to an uninsulated wire stretching from pole to pole, and grounded as frequently as an opportunity occurs.

Some of us will doubtless observe, that is much the same thing as the plan adopted to protect pole lines from the effects of atmospheric discharges in districts liable to destructive lightning storms. Well, it has that merit, and does decrease the liability of destruction from such cause; and I know, from experience, that it does also reduce the interfering effects of surface leakage, not, however, because it cures the disease, but because it enables the disease to expend itself in other directions. That is to say, the remedy collects at each pole the currents which otherwise would seek to complete their circuit through lines other than their own, and carries them off to the earth.

A more radical, more effective, and more economic remedy, because one which is really a prophylactic, is to make our insulation so perfect that we shall no longer have cross-arm conduction; or, at least, so little of it as to be negligible.

In the case, therefore, of disturbances introduced by surface conduction, we have remedies of two kinds. The best remedy—to employ a Milesianism—is prevention; and the other is of the class that shunts the parasite off into a path where it is relegated to innocuous desuetude.

If the attacking circuit is our own, we should employ the preventive method. If it belongs to another party—and we are members of the peace party—we may first try to get him to better insulate his wires, and, failing that, apply leakage conductors.

Tree leakage comes next. This may manifest itself as leakage from our wires to the tree, in which case it becomes an escape and is outside of the scope of this paper; but it may, and in my experience with electric railway disturbing currents often does also manifest itself as conduction of such currents from the tree, or more accurately from the disturbing wire to the disturbed wire by way of the foliage.

In well settled residential districts where to trim a tree seems to be regarded as an outrage to the community, this form of disturbance is a difficult one to deal with; yet, it is a form which, when the trouble comes from parallel trolley lines, can become very serious indeed; the more especially as such currents are always of very considerable volume, and are often produced under a sufficiently high pressure to overcome high resistances.

The remedies are, so far as I am aware of them :

A. To trim the trees, if permissible, so that they will not at any point touch the disturbed wires.

B. To adopt the weather-cross leakage conductors.

C. If the receiving instrument be a telephone, it may be shunted by an electromagnetic coil—called diversely a retardation coil, a choking coil, an obstruction coil, or an impedance coil, constructed of such proportions, and of such relation between the iron of its core and its winding, that it will freely allow the passage of the slowly changing disturbing current, such as that of the railway; but will be practically impervious to the telephonic current, which changes at a rapid rate, sometimes rising to a rate of 200,000 times per second.

We reach now disturbances attributable to conduction, coming upon telegraph or telephone circuits by way of the terminal ground wires. Since the electric railroad appeared among us this has been a serious source of trouble indeed.

Of course its attack on telephones is the most disastrous, since the telephone is the more sensitive instrument; but the currents are so strong that telegraph and signal wires do not escape.

If circumstances will permit us to arrange for our telegraph, signal or telephone lines a metallic circuit, we are generally thereby freed from disturbance, because we are fully freed from conductive disturbances reaching us by our terminal grounds ; it being obvious that we cannot be interfered with by the disturbing currents coming over ground wires if we have no ground wires. It may at first be supposed that the metallic circuit I am now speaking of is the same as that which is widely known as the only absolute specific for dynamic inductive disturbance ; but there is a difference. If we are dealing with leakage interference only, there is no necessity for arranging the two wires in parallelism, or equidistant from the disturbing circuit, and the circuit may if desired be in the form of a ring, just as a fire alarm, or messenger call circuit, where the only desiderata are to keep the circuit free from grounds, and from trouble coming by way of the grounds.

Disturbance due to electrostatic induction is now to be considered. Though for many years it has been recognized that this phenomenon does disturb highly insulated telegraph lines, and though from the outset it has certainly disturbed telephone lines, I am convinced that its influence is more widespread than has generally been supposed.

In electric railway disturbances I think its share is much greater than that of electro dynamic or magnetic induction; and experiments indicate that, as between railway and telephonic circuits, electrostatic induction interference is capable of manifesting itself in a pronounced manner at distances of from 150 to 1,000 feet, according to the length of the parallelism of the two systems ; and that these effects even unassisted by leakage are quite serious.

It has often been stated that electrostatic inductive interference is the worse as the insulation is the better. This is indeed true, but only because when there is high insulation there is slow discharge ; and for the same reason, if the insulation of telegraph and telephones is not extremely high, but is fairly high and *uniform*, they will work faster, because they will discharge quicker.

This points us to one remedy for static inductive disturbance, viz., that of leaks distributed over the length of the affected line. This expedient is partly advantageous, because it brings about a rapid discharge of accumulated electricity at intermediate points ; and it is disadvantageous because it is difficult to maintain a properly high resistance in the leaks ; which therefore tend to degenerate, first, into escapes ; and ultimately into dead grounds.

Another suggested remedy is to bring about an equal opposite charging influence, on both sides of the affected circuit. I do not, however, think this is a practical remedy.

In my opinion the leakage conductors and associated ground wires, already mentioned, will serve as a powerful partial remedy, especially if the wire running from pole to pole and grounded at intervals be in the form of a flat strip, and be placed on that side of the support which is nearest to the source of disturbances. A more or less perfect inductive screen is thus established and made useful.

Lastly we have to consider what we diversely call dynamic or magnetic induction, or sometimes (keeping in mind one way in which it is developed), magneto-electric induction ; an excellent servant but an intolerable master.

It is this kind of induction which unjustly has lent its

* From paper read at the Convention of the Association of Railway Telegraph Superintendents, Montreal, June 12 and 13, 1895.

name to all kinds of telephonic disturbance; and while we cannot spare it when usefully engaged in developing currents to be employed in the service of man, we must find means to frustrate its attempts to subvert such service.

We all know that the best, the most radical, and the only complete remedy for inductive disturbance due to this source is the "inductively neutral metallic circuit."

This is a perfect remedy. For since both wires of the circuit are alike, and are exposed to like induction, being equidistant from the source of disturbance, it follows that the induced current must be of the same value, and of the same direction in each wire; and that these two currents must therefore meet and neutralize one another; but it is not enough that the two-line wires of a metallic circuit shall be of the same length and resistance.

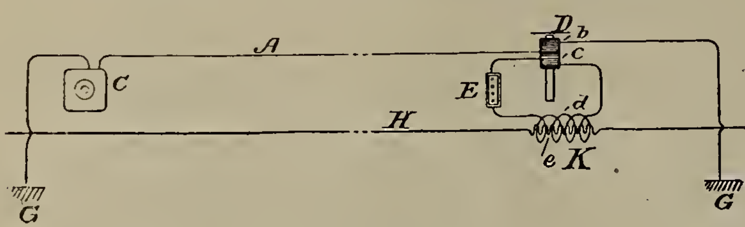


FIG. 1.

If a number of appliances be connected in one wire of the circuit and not in the other, the resistance is unevenly distributed; the balance is upset; and the circuit is not inductively neutral, because one of the conductors has between the ends of the circuit greater resistance than the other. The resistance of the circuit in such case is not uniformly distributed. It is highly important to know this, because the knowledge can be often applied to the agressive circuit. If, for example, we have a short telegraphic or signal line disturbed by an arc-light conductor which is already a metallic circuit, it will oftentimes not be necessary to double the telegraph line; and neutrality can be secured by providing that the double wire arc-light circuit shall have half of its lamps cut in one conductor, and the remaining half in the other.

Not so perfect an expedient, but still a useful one, is to retain our grounded circuit but loop it back through the region of disturbance. This generally reduces the interference; but, as I have said, it is not perfect; first, because the two sides of the circuit have unequal length; and second, because the earth remains a portion of the circuit, producing electrostatic reaction.

It is sometimes possible, even with grounded lines, to quiet them materially by transposing them in a variety of ways on their poles. No rule, however, can be given for this, as each case requires individual consideration.

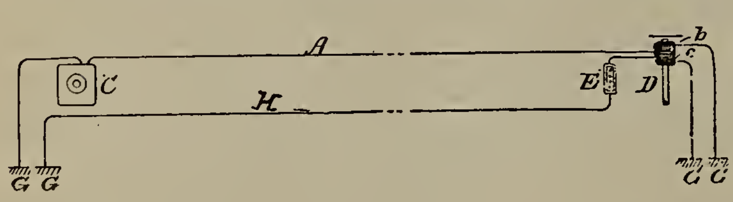


FIG. 2.

Sometimes, also, the disturbance is found to originate at some comparatively short intermediate section of a telephone line. In that event it becomes possible to make the circuit metallic at that point, for a length equal to the region of disturbance, connecting such section at both ends to continuations of the circuit by means of induction coils whose two windings are alike, and both formed of a considerable number of turns

The common return wire plan is useful in inductive disturbance also to some extent, although it does not produce for any individual circuit a perfect balance. But where the induction is not heavy, it may be profitably employed.

I have known also good results to be reached in the case of telephones provided with a differential winding, by causing the disturbing wire, if access can be had to it, to act directly on the telephone line, and thus on one winding of the telephone, and through an induction coil reversely on the second winding of the telephone, as in Fig. 1, where A is the telephone circuit, H the disturbing circuit, K the induction coil, G the ground connections, E a balancing resistance, D the telephone, *c* and *b* its windings, and *d* and *e* the windings of the induction coil.

Of course, as in Fig. 2, the disturbing line H may be caused to act as a neutralizer directly on the telephone D, in opposition to its action on the circuit A, provided the said line can be controlled.

My experience, however, is that it usually belongs to somebody else.

It not infrequently happens that the disturbing currents reaching telegraph and telephone circuits are from sources having a comparatively low electromotive force, lower in fact than that generating the working current. Especially is this the case in telephony.

When it occurs, a very simple partial remedy is to interpose a considerable resistance in the working circuit, and this being relatively greater with respect to the lower E.M.F. than it is to that of the working current, exercises a correspondingly greater subduing effect thereon.

I have known instances where in telephone systems an induction coil has been interposed between the receiving telephone and the line; but this is a useless expedient, because, though it truly cuts down the disturbance, it cuts down equally the message current, of which there is none to spare.

I cannot, of course, say that I have discussed all the remedies which have been proposed for disturbing currents in circuits arranged for electrical transmission of intelligence, but I have referred to some of those which experience has proved to be efficacious; and should this paper be so fortunate as to provoke a vigorous discussion, it will (discussion being invariably more valuable than papers,) have served its day and generation, feebly perhaps, but still forcibly and faithfully, considering the low E.M.F. of its source.

THE NATIONAL INDEPENDENT TELEPHONE COMPANY.

According to previous announcement in The Electrical Age, a meeting of representatives of independent telephone companies was held at the Hotel Duquesne, Pittsburgh, on June 24, for the purpose of organizing a national association for mutual interest and protection, as opposed to the Bell Telephone monopoly.

Among those present were J. E. Keelyn, president of the Western Telephone Construction Co., Chicago; J. G. Imhsen, of the Keystone Telephone Co., Pittsburgh; Frederick Harrington, Cleveland, O.; Chas. E. Black; National Telephone Mfg Co., Boston; R. C. Burns, American Electric Telephone Co., Kokomo, Ind.; H. T. Johnston, Manhattan Electrical Supply Co., New York; Wm. Dillion, Indianapolis Electric Co., Indianapolis, Ind.; A. F. Stanley, of Stanley & Patterson, New York; and A. H. Chadbourne, United States Telephone Construction Co., Philadelphia. Twenty-three of the leading independent companies were represented at the meeting.

At the morning session the association's work was outlined and a permanent organization effected. The meeting represented a combined capital of $50,000,000. Committees were appointed to report on the various phases of the work in sight.

It is reported that the Eastern representatives were not altogether satisfied with the manner in which the plans of the Association were laid down, claiming that the Eastern interests were not accorded as strong a representation in the affairs of the Association as their importance warranted; in other words, the East got little or no consideration and the West everything. At the present writing the meeting is still in session.

—Increase of temperature increases the electrical resistance of metals and decreases that of liquids, and decrease of temperature decreases the resistance of metals and increases that of liquids. An electrical conductor, therefore, varies in its resistance directly as the temperature, and the internal resistance of a galvanic battery varies inversely as the temperature.

New York Note.

Mr. George Kirkegaard, the well-known electrical engineer, is now engaged with the United Electric Light and Power Co., 109 Fulton street, New York. Mr. Kirkegaard is the inventor and designer of a number of arc lamps and other electrical apparatus now in extensive use. He is designing and supervising similar work for the company with which he is now engaged. W. T. H.

WHAT IS THOUGHT OF THE ELECTRICAL AGE.

"Monmouth, Ill :

"I have for some reason or other failed to receive the last issue of the Electrical Age Although I have been a subscriber for only a few weeks, it is such an interesting paper that I miss even a single copy. I think it is *the* paper of its kind. Very respectfully,

"C. P. L."

"Brooklyn, June 21, 1895.

"Enclosed please find one year's subscription for your paper. It is too good a paper for one to be without.

"A. B. See."

W. Preston Hix, who organized the Edison Electric Light Co , of Philadelphia, has commenced suit in the Court of Common Pleas for the recovery of $45,000 he alleges to be due him from that concern. For the work of organizing the company, it is stated, he was to receive 15 per cent. of the capital stock and 5 per cent. additional in the event of any increase. He has received his 15 per cent. and now seeks to recover $45,000 more as commission on the subsequently increased capital stock of the company.

The Westinghouse Electric Company has declared a quarterly dividend of 1¾ per cent. on its preferred stock, payable July 1.

Telephone Notes.

Thos. M. Ferguson, Meridian, Miss., has secured a franchise to construct a telephone line.

Charles E. Johnson, Raleigh N. C., will construct a telephone line to Hamlet, a distance of 96 miles.

The Wisconsin Telephone Company will soon establish a new rate schedule in Milwaukee. Reduced rates have already been enjoyed throughout the rest of the state for some weeks, and it was only through meetings of subscribers in Milwaukee that the company has been compelled to take cognizance of the dissatisfaction in that city over the existing rates.

The Home Telephone Company, Sioux City, Ia., expects to have its exchange in operation very soon. This company will furnish free service for the city, and the contract with the Iowa Union Telephone Company will be cancelled June 30. The latter company has been renting instruments to the city at one-half the regular rates, and proposes to fight against the cancellation of the contract in favor of its rival.

The Blue Earth Valley Telephone Company, Winnebago City, Minn., proposes to build a line to Fairmount, Minn.

Exchanges on the Standard Telephone and Electric Company's system are to be established at Mineral Point, Wis., Prairie du Chien, Wis. and Tomah, Wis.

A telephone line was recently opened between London, Dublin, Belfast, Edinburgh and Glasgow.

The Columbian Standard Telephone Company has been organized with L. C. Hine, Washington, president ; Gen. Felix Agnus, Baltimore, vice-president ; Geo. W. Cross, general manager. The company still operate exclusively in Maryland, District of Columbia, Virginia and West Virginia, with headquarters in Washington.

The American Telephone and Telegraph Company has been organized in Nashville, Tenn., by Edward P. Meany, Melville Eggleston, Jas. E Caldwell and others.

TELEPHONE PATENTS ISSUED JUNE 18, 1895.

Telephone System.—William W. Dean, St. Louis, Mo. (No. 541,077.)

Street Railway Notes.

There is talk of building an electric railroad from Louisville to Fairfield, Ky.

Mr. W. M. Hewitt has been appointed the receiver for the Stillwater Street Railway Company, Stillwater, Minn.

The Portsmouth Street Railway Company will build its electric road. Mr. J. G. Siegfried is president.

Regarding the note in our issue of June 8, concerning the Anniston City Electric Railway, Anniston. Ala., we are informed that the electrical equipment of this road has been finished 60 days. The work was done under the management of Howard W. Sexton, trustee.

The Washington and Great Falls Electric Railway Company, Washington, D. C., has called for bids for an issue of $100,000 first mortgage, six per cent., thirty-year gold bonds, part of the total authorized issue of $500,000.

Possible Contracts.

F. C. Goodwin, Reynolds, Ga., is in the market for incandescent dynamos.

L. G. Hallock, Wheeling, W. Va., will build the Exchange Bank Building in that city, to cost $38,000.

F. W. Wagener & Co , Charleston, S. C., propose to extend their electric light plant and add new machinery.

Thomas & Bohne, Louisville, Ky., have prepared plans for two large warehouses, which will require electric light equipments.

Dunlap, Iowa, is taking steps to introduce an electric light plant.

An electric light plant is to be established in Norwood, Ohio.

The electric light plant in Madisonville, Ohio, is to be extended, and the water-works trustees have been asked to issue $5,000 in bonds to defray the cost.

New Corporations.

The Milwaukee Electric Manufacturing Company, Milwaukee, Wis., by John E. McKivitt, Mathias Weisser and others. Capital stock, $8,000.

The Chatham Electric Light, Heat and Power Company, Chatham, N. Y., by J F. Farrell, of Albany; H. H. Francis and J. O. Carr, of Schenectady. Capital stock, $10,000.

North American Power, Light and Traction Company, Beatrice, Neb., by Ex-Senator A. S. Paddock, F. A. Paddock, F. Murphy, of Omaha, M. Stein, of New York City, R. S. Forbes, of Washington. Capital stock, $1,000,000.

Jacobson-Blosser Electric Company, Portland, Me., with C. B. Jackson, of Boston, president; Alfred Prince, of Quincy, Mass., treasurer. Capital stock, $200,000.

Electrical Directory Company, Augusta, Me., F. E. Sanborn, Portland; E. H. Peabody, of Boston; W. S. Baldwin and J. Wade, of Augusta, Me., to operate electric city directories, electric and railroad time-tables. Capital stock, $100,000.

The Dallas Rapid Transit and Terminal Company, Dallas, Tex., by B. S. Wathen, A. F. Hardie and others, to build an electric road in the city and vicinity.

The Portland Light and Power Company, Portland, Conn., by Frederick De Puyster, E. P. Bigelow and James H. Pelton and others. Capital stock, $5,000.

The People's Light, Heat and Power Company, Hastings, Neb., by William E. Brevoort, Charles E. Bascombe and Samuel S. Campbell. Capital stock, $100,000.

The Wolverine Electric Company, Detroit, Mich., by Charles E. Scott, of Piqua, Ohio; H. A. Marks, Hiram Marks and George A. Brooks, of Piqua, Ohio. Capital stock, $10,000.

The Batesville and Oldenberg Electric Company, Batesville, Ind., by K. M. Hord, Bellami Sutton, E. K. Adams, and John A. Tindall, of Shelbyville; Jonas Joseph, of Noblesville, and John Hillenbrandt, of Batesville, and others. Capital stock, $50,000.

Marion Water Company, Portland, Me., C. C. Chapman, president; C. J. Chapman, treasurer, both of Portland, for the purpose of operating water-works, gas and electric works. Capital stock, $250,000.

Adams Power Company, Adams, Vt., with Charles A. Howland, president; W. H. Wellington, treasurer; for the purpose of conducting a power station, etc. Capital stock, $250,000.

The Interurban Rapid Transit Company, Tiffin, Ohio, by Mesheck Frost, Amandus Betts, Norman McCarty and others. Capital stock, $250,000.

The Bissell, Dodge & Erner Company, Toledo, Ohio, by Frederick Bissell, Frederick H. Dodge, John A. Erner, A. W. Scott and G. G. Kelp, to manufacture electrical and other machinery. Capital stock, $25,000.

The Northern Electric Company, Norwalk, Ohio, by George P. Jones, Parks Foster, Mayme C. Foster, Burton P. Foster, John W. Foster. Capital stock, $25,000.

THE LOUISIANA ELECTRIC LIGHT CO.

It is reported that the United Electric Securities Company, of Portland, Me., has asked for the appointment of a receiver for the Louisiana Electric Light Company, New Orleans, La., which furnishes all the lights for the city of New Orleans as well as the motor power for the various street railroad lines. The Maine company is the holder of 2,125 shares of stock of the Louisiana Electric Company, and asserts that the company's affairs have been mismanaged and the funds diverted by some of the directors to other concerns in which they are interested.

BIDS INVITED.

The Navy Department, Washington, is asking for proposals for the following supplies, for the use of the Washington Navy Yard, bids for which will be received until July 2, 1895. The following is a list of the required articles:

0 Arc Lamps, single carbon (9.6 amp.)

1400 Feet No. 6 B. and S. G. Wire, rubber insulation, braided finish, price of which is to be given per single foot.

6 Insulators, porcelain, split.

14 Pulleys galvanized iron, single sheaf, 1½ in. diameter.

250 Feet ⅜ in braided arc lamp cord.

2 Arc Lamps, single carbon (9.6 amp.)

1,500 Feet No. 6 B. & S. G. wire, rubber insulation, braided finish.

50 Pins, oak, 1½ in. diameter.

6 Insulators, porcelain, split.

16 Pulleys galvanized iron, single sheaf, 1½ in. diameter.

250 Feet ⅜ in. braided arc-lamp cord.

50 Couplings brass, for No. 4 wire.

3 Pounds Tape, okonite rubber.

800 Feet No. 2 B. & S. G. Wire, copper, triple-braided insulation (about 176 pounds.)

2,500 Feet No. 8 B. & S. G. Wire, copper, triple-braided insulation (about 187.5 pounds.)

60 Key Wall Sockets, Thomson-Houston pattern, porcelain base.

4 (two-wire) Double-Pole, Double-Branch Cut-Outs, porcelain mounting, for 3 amp. fuses.

4 Double-Pole, Single-Throw 10 amp. Switches.

2,000 Cleats, wood, $\frac{3}{16}$ in. slot (two-wire.)

2 Double-Pole, Single-Throw 50 amp. Knife Switches, slate base from terminals, to match those already on switchboard.

2 Double-Pole Fuse Blocks for 50 amp. link fuses, slate base, to match those already on the switchboard.

All of the foregoing material is to be of the best quality, and is to be delivered on or before July 15, 1895. Specifications and all necessary information can be obtained on application to the Bureau of Supplies and Accounts, Navy Department.

THE SOLAR ELECTRIC COMPANY.

A syndicate composed of Hewitt Boice, of Kingston, N. Y., Andrew Baird, of Brooklyn, Senator Jacob Rice, of Kingston, N. Y., and Samuel O'Connor, of Brooklyn, has bought the business of the Solar Arc Lamp Company, and that of the Brooklyn Electric Manufacturing Company, and have organized a new company under the name of the Solar Electric Company, of New York.

The new company's factory and offices are in the Vernon Building, 65 and 67 Duane street, and 593 and 595 Pearl street, New York, and the officers are: Hewitt Boice, president; Andrew Baird, vice-president; George A. Mullin, secretary and treasurer, and St. Louis Wintner, general manager.

Mr. Hewitt Boice, the president of the new company, is prominently identified with other important business interests, being president of the Blue Stone Association; president of the National Bank, of Kingston, N. Y., and president of the Catskill Railroad. Mr. Andrew Baird is proprietor of a large stone yard in Brooklyn, and is very wealthy; Senator Jacob Rice is intimately identified with the shipping interests of New York, and Mr. Samuel O'Connor is the well-known conduit builder.

For some time rumors have been in circulation regarding the consolidation of these two interests. It was through the efforts of Mr. Mullin that the deal was brought to a successful termination.

In recognition of the skilful manner in which he brought about the consolidation Mr. Mullin received a bonus and a large interest in the new business. The new company will manufacture incandescent arc lamps, switchboards, quick-break switches, and other switches of all styles and sizes.

The Brooklyn Electric Manufacturing Company, as is well known, has for the past year done a great portion of the business of switchboard installations. The company made and installed the switchboards in many of the largest buildings in New York city and vicinity, having put in no less than 65 since January 1, last.

The new company has already taken orders for several hundred arc lamps, and has a large number of switchboards on hand.

LEGAL NOTICE.

In pursuance of an order of Hon Joseph F. Daly, Chief Justice of the Court of Common Pleas for the City and County of New York, notice is hereby given to all persons having claims against Charles E. Chapin, lately doing business at No. 136 Liberty street, in the City of New York, to present the same with the vouchers thereof duly verified, to the subscriber, John K. Creevey, who has been duly appointed assignee of said Charles E. Chapin for the benefit of his creditors, at his office No. 41 Wall street in the City of New York, on or before the 10th day of September, 1895.

Dated New York, June 1, 1895.

John K. Creevey,
Assignee.

NEW SPRING MOTOR.

Frederick Pearce, the manufacturing electrician, 79 John street, New York, lately brought out a novel spring motor for running the phonograph. It is automatic in its speed and is arranged to run at any speed by the adjustment of a regulator, in order to get the exact tone in the phonograph. The motor runs a phonograph long enough to play two tunes. It can be adapted to automatic nickel-in-the-slot machines, as it takes but little power to wind it.

WOVEN WIRE BRUSHES.

The Belknap Motor Co., of Portland, Maine, are the patentees and manufacturers of the best woven wire commutator brush on the market.

Trade Notes.

The Oliver P. Clay Company, 311 and 312 The Arcade, Cleveland, O., have issued a pamphlet illustrating and describing the two-way flue cleaner sold by them.

The Partridge Carbon Co., Sandusky, Ohio, is enjoying a constantly increasing demand for its celebrated carbon brushes for motors, etc. These brushes are said to be superior to any on the market. They are self-lubricating and do not cause any undue wear on the commutator.

The Metropolitan Electric Company, 186-188 Fifth avenue, Chicago, are not complaining about slow business, their sales having multiplied this year three times the amount at the same period last year. The company is young in age but a giant in strength, and has entered upon an era of prosperity that is marvelous for these times. They handle some of the best known specialties on the market; among them, P. & B. goods, N. I. R. Rubber Wire, Solar Arc Lamps, Metropolitan Incandescent Lamps, the Portable Hose Bridge, etc.

The American Engine Company, of Bound Brook, N. J., manufacturers of engines and dynamos, is taxed to its utmost capacity in its endeavor to keep up with the orders coming in. Eighty hands are now employed in the works, and the company has no less than $50,000 worth of orders in hand. The Lehigh Valley Railroad Company is running a track into the works, in order to facilitate the shipment of machinery direct from the factory. The company has many contracts on hand for both engines and dynamos. The American Engine Company makes the well-known dynamo of Mr. O. P. Loomis.

National Electric Light and Street Railway Associations.

NATIONAL ELECTRIC LIGHT ASSOCIATION.

President, C. H. Wilmerding, Chicago, Ill.; 1st Vice-President, Frederic Nicholls, Toronto, Canada; 2d Vice-President, E. F. Peck, Brooklyn, N. Y.

Members of Executive Committee: E. H. Davis, Williamsport, Pa, (one year); W. R. Gardiner, Pittsfield, Mass.; George A. Redman, Rochester, N. Y.; J. J. Burleigh, Camden, N. J. Next meeting, New York, May or June, 1896.

AMERICAN STREET RAILWAY ASSOCIATION.

Next meeting, Montreal, Que., October, 16, 17 and 18, 1895.

President, Joel Hurt, Atlanta, Ga.; Vice-President, W. Worth Bean, St., Joseph, Mich.; 2d Vice-President, John M. Cunningham, Boston, Mass.; 3d Vice-President, Russell B. Harrison, Terre Haute, Ind., Secretary and Treasurer, William J. Richardson, Brooklyn, N. Y.; Executive Committee, Henry C. Payne, Milwaukee, Wis.; W. H. Jackson, Nashville, Tenn.; D. G. Hamilton, St. Louis, Mo., C. C. Cunningham, Montreal, Canada; J. N. Partridge, Brooklyn, N. Y.

NEW YORK STATE STREET RAILWAY ASSOCIATION.

Next meeting, Albany, N. Y., third Tuesday in September, 1895.

President, G. Tracy Rogers, Binghamton; First Vice-President, John H. Moffitt, Syracuse; Second Vice-President, W. W. Cole, Elmira; Secretary and Treasurer, William J. Richardson; Brooklyn; Executive Committee, D. B. Hasbrouck, New York; John N. Beckley, Rochester; Daniel F. Lewis, Brooklyn.

OHIO STATE TRAMWAY ASSOCIATION.

Next meeting, fourth Wednesday in September, 1895.

President, Albion E. Lang, Toledo; Vice-President, W. J. Kelly, Columbus; Secretary and Treasurer, J. B. Hanna, Cleveland; Chairman Executive Committee, W. A. Lynch, Canton.

MASSACHUSETTS STATE STREET RAILWAY ASSOCIATION.

President, T. H. Cunningham, Boston; Secretary and Treasurer, A. S. Butler, Lawrence; Executive Committee, Samuel Winslow, Alfred A. Glazier, Boston; P. F. Sullivan, Lowell; E. C. Foster, Revere; Horace B. Rogers, Brockton; A. E. Smith, Springfield; Prentiss Cummings, Boston.

THE TEXAS STREET RAILWAY ASSOCIATION.

President, W. H. Sinclair, Galveston; vice-president, C. A. McKinney, Houston; Secretary and Treasurer, C. L. Wakefield, Dallas. Directory: The officers and W. H. Weiss, San Antonio and George B. Hendricks, Fort Worth.

Next meeting, Galveston, third Wednesday in March, 1896.

PENNSYLVANIA STATE STREET RAILWAY ASSOCIATION.

Next meeting, first Wednesday in September, 1895.

President, John A. Rigg, Reading; First Vice-President, Robert E. Wright; Secretary. S. P. Light, Lebanon; Treasurer, W. H. Lanius, York.

THE MAINE STREET RAILWAY ASSOCIATION.

President, W. R. Wood, Portland; Secretary and Treasurer, E. A. Newman, Portland; Executive Committee, W. R. Wood, Portland; George E. Macomber, Augusta; F. M. Laughton, Bangor; Frank W. Dana, Lewiston; Amos F. Gerald, Fairfield.

MICHIGAN STATE STREET RAILWAY ASSOCIATION.

President, W. L. Jenks, Port Huron; Vice-President, W. Worth Bean, St. Joseph; Secretary and Treasurer, B. S. Hanchett, Jr., Grand Rapids; Executive Committee, the Officers and David H. Jerome, Saginaw, and Strathern Hendrie, Detroit.

THE STREET RAILWAY ASSOCIATION OF THE STATE OF NEW JERSEY.

President, Thos. C. Barr, Newark, Vice-President. W. S. Scull, Camden; Secretary and Treasurer, Charles Y. Bamford, Trenton; Executive Committee, Officers and C. B. Thurston, Jersey City; H. Romaine, Paterson S. B. Dod, Hoboken.

Electrical and Street Railway Patents.

Issued June 18, 1895.

541,073. Electric-Car Brake. George B. Damon, Lowell, Mass., assignor of one-half to Gardner W. Pearson, same place. Filed Apr. 30, 1894.

541,077. Telephone System. William W. Dean, St. Louis, Mo., assignor to the Bell Telephone Company, of Missouri, same place. Filed Feb. 21, 1895.

541,081. Storage-Battery and Method of Making Same. Nathan H. Edgerton, West Whiteland, Pa. Filed Feb. 27, 1894.

541,098. Crossing for Trolley-Wires. John Kroger, Pleasantville, N. J. Filed Nov. 3, 1894.

541,121. Device for Conducting Electricity to Lamps, &c. George F. Rose, London, England. Filed Feb. 27, 1895. Patented in England Dec. 24, 1891, No. 22,542.

541,126. Trolley-Wheel. Charles Smith, Belleville, N. J., assignor to the Eastwood Wire Manufacturing Company, same place. Filed Mar. 30, 1894.

541,136. Rheostat or Other Circuit-Controller. Charles Willms, Baltimore, Md. Filed Nov. 26, 1894.

541,137. Calcium-Carbide Process. Thomas L Willson, New York, N. Y. Filed Jan. 16, 1895.

541,138. Product Existing in Form of Crystalline Calcium Carbide. Thomas L. Willson, New York, N. Y. Filed Mar. 4, 1895.

541,146. Electrolytic Process and Apparatus. Henry Blackman, New York, N. Y. Filed July 2, 1894.

541,148. Current-Strength Indicator. Percival G. Burgess, Boston, Mass., assignor to the American Bell Telephone Company, same place. Filed Mar. 25, 1895.

541,149 Transmitter. John Burry, New York, N. Y. Filed Oct. 23, 1893.

541,165. Electric Railway. Rudolph M. Hunter, Philadelphia, Pa. Original application filed Jan. 12, 1887. Divided and this application filed Sept. 7, 1889.

541,179 Electric-Arc Lamp. Chas. A. Pfluger, Chicago, Ill., assignor to the Standard Electric Company, same place. Filed July 2, 1894.

541,194 Electric Switch for Railways. Leonard Wheeler, Sioux City, Iowa. Filed June 8, 1894

541,200. Electric Elevator. Rudolf Eickemeyer, Yonkers, N. Y. Filed Oct. 1, 1890.

541,227. Electric Switch. Chaimsonovitz P. Elieson, London, England. Filed July 16, 1894.

541,233. System of Electrical Distribution. Charles K. Huguet, New Orleans, La Filed Jan 30, 1895.

541,243. Push-Button. Frederick W. Manger, Brooklyn, N. Y., assignor to Huebel & Manger, same place. Filed Oct. 1, 1894.

541,268. Car-Fender. Adolphus Decker, Linoleumville, N. Y. Filed Mar. 30, 1895.

541,290. Arc Lighting. Samuel W. Rushmore, Brooklyn, N Y. Filed Mar. 20, 1895.

541,312. Car-Fender. James L Canham, South Orange, N. J., assignor of nine-sixteenths to Robert Avery, Brooklyn, N. Y., and J H Jacobs, Orange, N. J. Filed Jan. 22, 1894.

541,332. Insulator. James M. Patterson, Springtown, Tex. Filed Apr. 10, 1895.

541,338. Underground Closed-Conduit System for Electric Railways. Adolph J. Smith, Milwaukee, Wis. Filed June 6, 1894.

541,341. Electric Alarm Signal and Indicator for Trolley Railroads Jacques A. Buisson, New Orleans, La. Filed Apr. 2, 1895.

541,357. Compound Wound Alternating Generator. John D. Hilliard, Jr., Bluefield, W. Va. Filed June 21, 1894.

541,365. Switch for Overhead Railways. Eugen Langen, Cologne, Germany. Filed Apr. 6, 1895.

541,366. Switch for Overhead Railways. Eugen Langen, Cologne, Germany. Filed Apr. 6, 1895.

541,367. Electric Truss. B. R. Lathrop, Weedsport, N. Y Filed Aug. 27, 1894.

541,373. Street-Car Register. Onesime E. Michaud, St. Louis, Mo. Filed July 21, 1894.

541,380. Armature for Electric Motors and Generators. John F. McLaughlin, Philadelphia, Pa. Filed Dec. 5, 1891.

541,383. Car-Fender. John Nagele, Clarendon, Ark., assignor of one-half to E. F. Nagele, Memphis, Tenn. Filed Sept. 20, 1894.

541,389 Electric Train-Signal. Edward J. Devine, Port Arthur, Canada. Filed Dec. 11, 1894.

541,415. Street-Car. Frederick A. Baier, St. Louis, Mo., assignor to the Brownell Car Company, same place. Filed Nov. 13, 1894.

541,421. Street-Railway Switch. Gustaf Borgeson, Brooklyn, N. Y. Filed Jan. 15, 1894.

456 REPLIES FROM ONE NOTICE IN THE

ELECTRICAL AGE

Established 1883. An Illustrated Weekly Electrical Journal. 10 cents per copy

VOL. XV.—No. 424. NEW YORK, JUNE 29, 1895. Subscription, $3.00 per year. Foreign Countries, $4.00 per year.

ELECTRICAL AGE is 12 YEARS OLD.

STANDARD Plante Storage Batteries

OF TRUE

PLANTE TYPE AND CRYSTALLINE FORMATION.

CHALLENGE.

We will place an equal number of these cells in series-circuit with any other cells of like capacity, and submit them to charge and discharge currents as high as the circuit can give and receive; and, we guarantee no distortion or deterioration of plate in our cells, under currents that no other cell will withstand.

Will give or receive WITHOUT INJURY Currents that would DESTROY OTHER BATTERIES.

WILL NOT SULPHATE, DISINTEGRATE, OR BUCKLE.

Contain no asbestos or other separating material to increase internal resistance.

ESPECIALLY ADAPTED TO CENTRAL STATION AND POWER-HOUSE SERVICE.

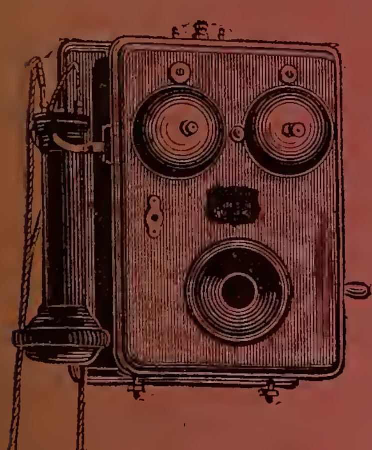
Absolutely free circulation of electrolyte preventing discharge of one plate into another.

HIGHEST EFFICIENCY, LARGEST DELIVERY, LOWEST INTERNAL RESISTANCE.

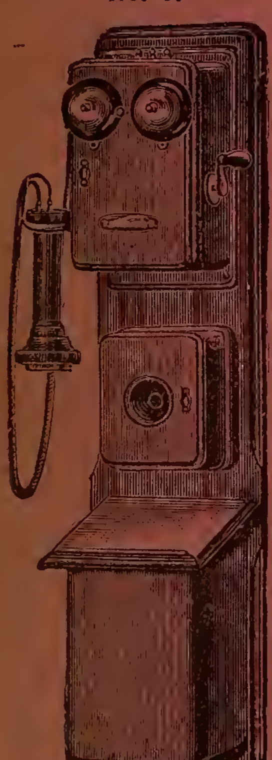
For efficiency, reliability, durability, and capacity to receive and yield excessive currents, unequalled by any other battery on the market in this country. *Cannot be damaged by excessive charge or discharge currents.*

A 400-AMPERE CURRENT HAS BEEN TAKEN FROM A 120-AMPERE HOUR CELL.

ELECTRIC POWER STORAGE COMPANY, - 166 ELM STREET, NEW YORK.



No. 1.



No. 1.

PHŒNIX Interior Telephone Company

Manufacturers of Battery Telephones.

Make a Specialty of

BLAKE TRANSMITTERS

And Claim them the Best in the Market.

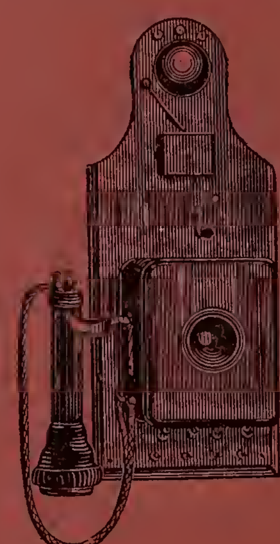
Our Independent Switch System for interior work is the neatest and most convenient yet devised. Any number of stations can be connected independently without a central station. Wired in factory for any number of stations desired.

TELEPHONES COMPLETE

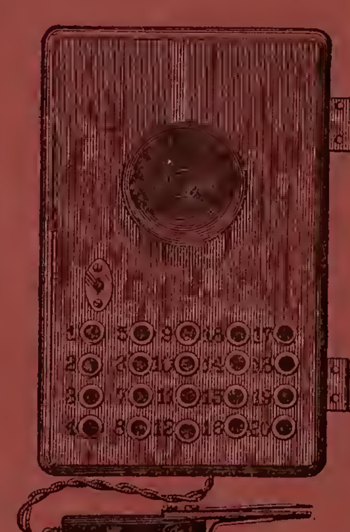
or in parts. Standard and Watch Case Receivers, Telephone Cords, Induction Coils, Dry Batteries, Vibrating Bells, and Buzzers, Magneto Bells, Telephone Wire and Cables, and in fact, everything in the way of Telephone Supplies. Electrical Houses wanted in every town to handle our goods. Discount to the trade.

Write for Illustrated Catalogue.

—PHŒNIX—
INTERIOR TELEPHONE CO,
133 LIBERTY ST.
NEW YORK, U. S. A.



No. 5.



No. 2 A.
Independent Switch System.

A Complete Life of Napoleon Free

* * * *

FOR THE REGULAR PRICE OF SUBSCRIPTION we will send to a NEW subscriber for one year, PUBLIC OPINION and a beautifully cloth bound copy of Miss Tarbell's "Life of Napoleon," or for six (6) months' subscription we will send the same book bound in illuminated paper covers. The subscription price of PUBLIC OPINION is $2.50 per year; $1.25 for six months.

This "Life of Napoleon" has been appearing in *McClure's Magazine* for some months past and has called forth a great deal of favorable comment. It has just been published in book form at the price of $1 00 for cloth and 50 cents for paper bound copies. The book contains over 250 *illustrations*, including those from the Hubbard collection, as well as those obtained abroad. 250 pages. It is printed on the finest coated paper, and is a handsome volume in every respect, as well as a thoroughly reliable history.

If the book is not satisfactory it may be returned at our expense and the amount paid will be refunded.

THE PUBLIC OPINION CO.,
13 ASTOR PLACE, NEW YORK.
(Sample Copies of PUBLIC OPINION sent on request.)

SPECIALTY ADVERTISING CANVASSERS—Men familiar with premium mercantile trade; money maker of 1894. Stanley-Bradley Pub. Co., No. 7 E. 16th St., New York.

THIS SPACE RESERVED........

FOR THE

SOLAR ELECTRIC CO.,

65-67 DUANE ST., - - 593-595 PEARL ST., NEW YORK.

INDEX TO ADVERTISERS.

BUYERS DIRECTORY

Advertisements of 4 lines or less under this head $20 per year, additional lines at proportionate rates.

NEW JERSEY.

McIntire's Patent, Connectors and Terminals for all Electrical purposes. Incandescent Lamp and Cut-out Terminals for all makes of Lamps. General Electrical Supplies. The C. McIntire Co., 13 and 15 Franklin st., Newark, N. J.

NEW YORK CITY.

Bateman & Miller, contractors for Electric Light Wiring of Buildings, Isolated Plants, Complete Installations. Electric Railroads, Marine, Village and Station Work solicited. Electric Bells, Burglar Alarms and Speaking Tubes. 143½ East 23d street, N. Y.

Jaeger Electric Lamp Co., 154-156 West 27th Street, N. Y. Manufacturers of Miniature Lamps for Decorative and Sign purposes, etc., etc.

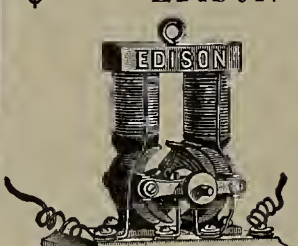
Brandt's "Triple Expansion Gaskets," for man and hand holes of boilers. Guaranteed to be the best gasket for high steam pressures. Randolph Brandt, manufacturer, 38 Cortlandt St., New York.

Standard Underground Cable Company, Electric Wires and Cables for Aerial, Underground and Submarine use, and for all classes of service. Pittsburgh, New York and Chicago.

MANAGER AND INVESTOR WANTED.

Electrician with $3,000 or $4,000 to take interest in, and full management of lighting plant and business. Growing town, 2,000 population. Guaranteed receipts, $300 to $400 per month to start with, and sure to increase. I own exclusive franchise, but have no knowledge of the business. Write fully. G. L. Hubbell, Waukon, Iowa.

$1.00—EDISON MOTOR.—$1.00



Largest and strongest dollar motor made. Send a sample order and be convinced. On receipt of $1.25 we will send it prepaid to any part of the U. S. or Canada; or on receipt of $1.00 and you pay expenses. This motor can be run by any battery, but our own is best suited. Price, 25 cents. Can be sent with motor, or if by mail, postage, 7 cents. *We also manufacture and deal in*

Motors of All Sizes, Castings, Parts, Etc.,

for dynamos, motors, steam and gas engines. Students' and experimenters' supplies of every description.

SEND STAMPS FOR CIRCULARS.

Franklin Electric Co., Miamisburg, Ohio.

Electrical Engineers and Contractors,

RECOMMENDED BY

THE ELECTRICAL AGE.

Advertisements of 4 lines or less under this head $26 per year, additional lines at proportionate rates.

HAZAZER, E. W.
Electrical Engineer, Specifications and Superintendence, 35-37 Frankfort St., N.Y.

HALL, J. P.
Electrical Contractor, Office, Rooms 328 and 329 Central Building, 143 Liberty St, New York. Telephone 2490.

HARRISON, NEWTON, E. E.
Electrical Engineer and Contractor. Estimates furnished for central station and isolated lighting and power plants. General contracting a specialty. Room 14, World Building, New York.

ZIMDARS & HUNT.
General Electrical Contractors. Wiring complete plants, etc. 127 Fifth Ave., New York, N. Y.

CHINNOCK, F. R.
Electrical Contractor, Electric Light and Railway complete plants installed. Late agent Edison United Mfg. Co., Edison Illuminating Co., Brooklyn; General Electric Co., Ball Engine Co. Havemeyer Bldg., New York.

HATZEL & BUEHLER,
Electrical Engineers and Contractors. 114 Fifth Avenue, New York.

WANTS, FOR SALE, ETC.

FOR SALE.

Several second-hand INDICATORS slightly soiled from experimental use but good as new. Hine & Robertson Co., 55 Cortlandt Street, New York.

FOR SALE.

One Hundred Battery Motors, with 8-inch fan, will be sold at once for $3 each. Wm. Westcott, 114 Liberty St., N.Y.

WANTED.

Position as superintendent or electrician of electric light or power plant. Not particular about location. Looking for good plant in need of a competent engineer. At present located, but desire betterment. Address, Eng., care Electrical Age, World Building, New York.

BARGAIN.

A few Blake transmitters and Bell telephones, $4. per set. Guaranteed perfect. Address "E," care Electrical Age.

BARGAIN.

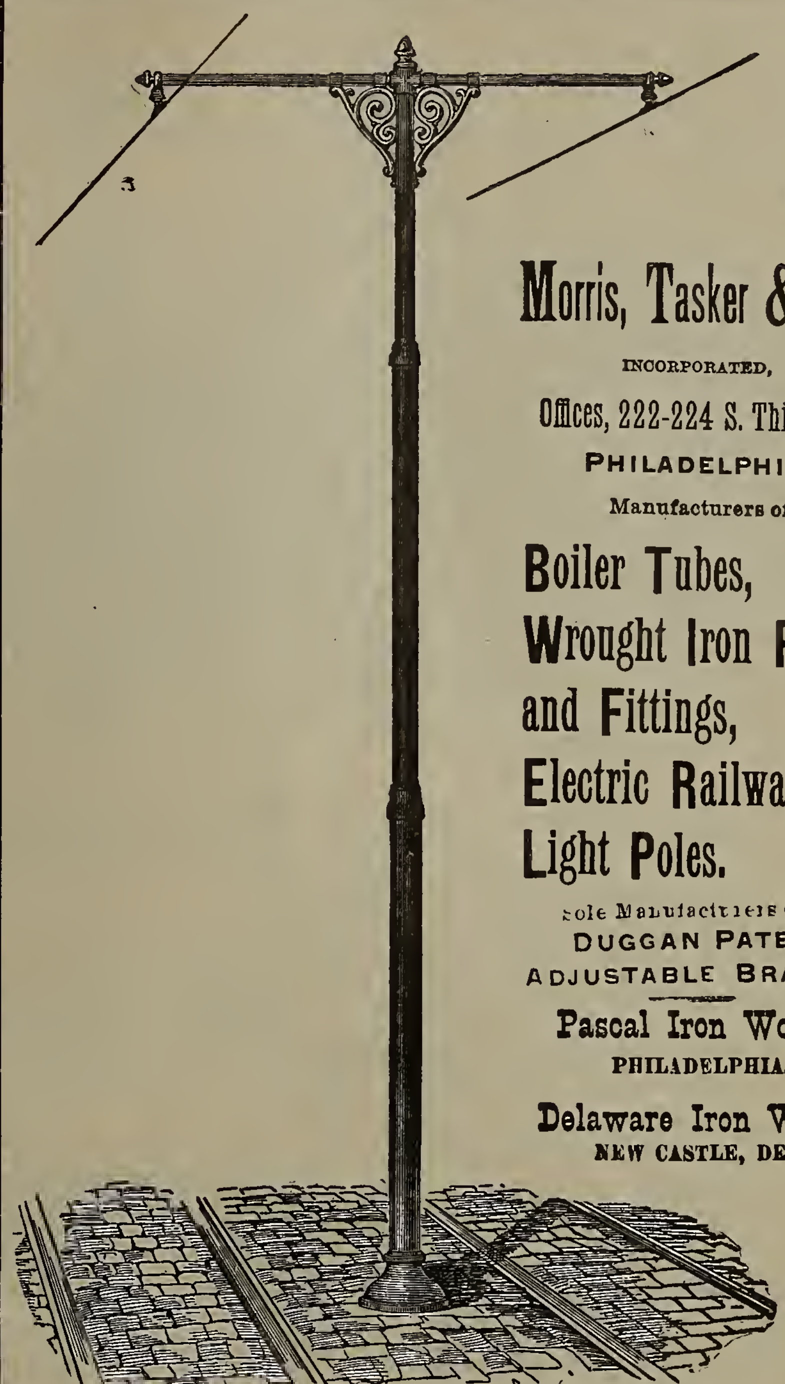
Stock of Lundell Ceiling Fan Motors, $15 each. Come quick if you want one or more.
J. Jones & Son,
67 Cortlandt St., N. Y.

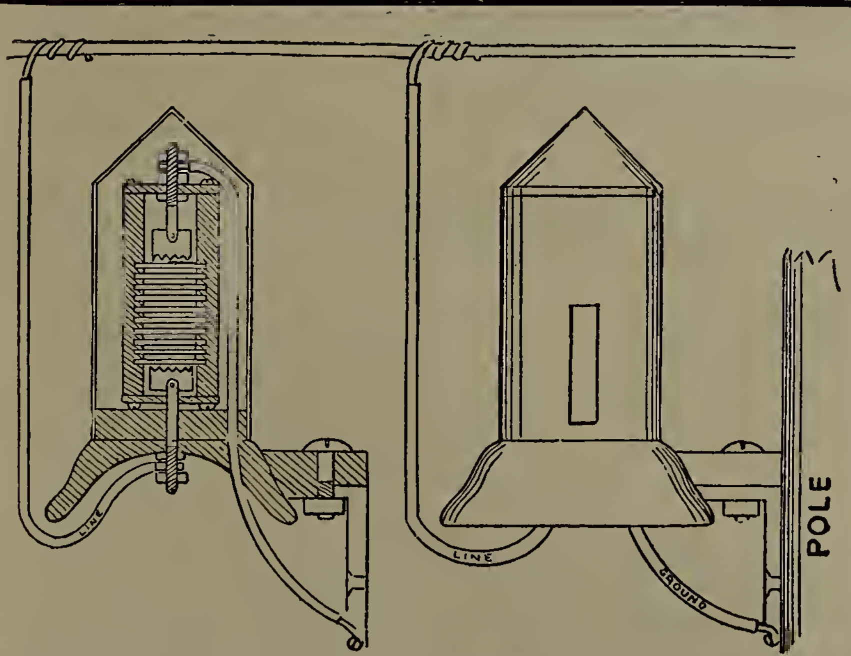
The Adams' Improved Transformers.

Are Adopted by the Largest Stations in the Country.

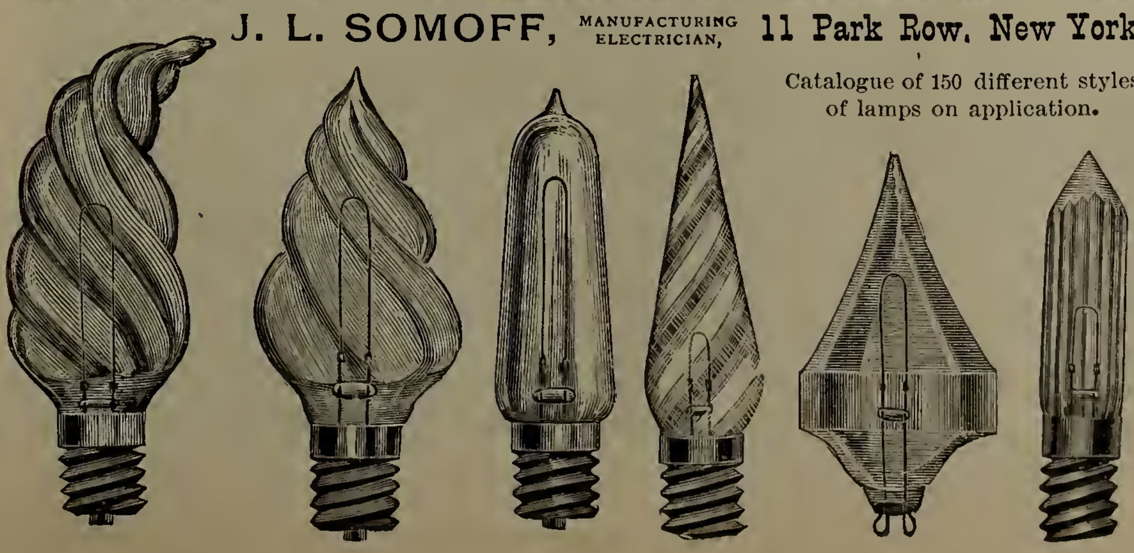
We invite competition in ANY FORM OF TEST, in laboratory or practical use. Our Transformers are Guaranteed for Two (2) Years against lightning, or other destructive discharges. The only indestructible Transformer made, and is sold at the lowest prices. Send for sample and be convinced. (Selling Agents Wanted

ADAMS ELECTRIC CO., ELKHART, IND.





LINE
LINE
GROUND
POLE



CLASSIFIED LIST OF MANUFACTURERS OF ELECTRICAL and KINDRED SUPPLIES.

Alarms, Burglar and Fire.
Baxter, H. E. & C., Brooklyn, N. Y.
Bogart, A. L , New York
Edwards & Co., New York
Herzog Teleseme Co., New York
Holtzer-Cabot Electric Co., Boston, Mass.
Huebel & Manger, Brooklyn, N. Y.
Jones & Son, J., New York
Ostrander & Co., W. R., New York
Manhattan Electrical Supply Co., New York
Boston Electric Co., Boston, Mass.
Bunnell & Co., J. H., New York
Heath Electric Co., Detroit, Mich.
Partrick & Carter Co., Philadelphia, Pa.
Pearce, Frederick, New York
Western Electric Co., New York
Ziegler Electric Co , Boston, Mass.

Armatures.
Eastern Electric Equipment Co., Cleveland, O.
Elliott-Lincoln Electric Co., Cleveland, O.
Steel Motor Co., Cleveland, O.
Bogue, Chas. J., New York
Rushmore, S. W., Jersey City, N. J.
Stucky & Heck, Newark, N. J.

Aluminum.
Illinois Alloy Works, Chicago
Cowles Electric Smelting and Aluminum Co., Lockport, N. Y.
Jersey City Smelting Works, Jersey City, N. J.
Pittsburgh Reduction Co., Pittsburgh, Pa.
Platt, C. S., New York

Annunciators.
Partrick & Carter Co., Philadelphia, Pa.
Electric Guest Call Co., Minneapolis, Minn.
Greeley & Co., The E. S., New York
Standard Electrical Works, Cincinnati, O.
Stanley & Patterson, New York
Washington Electric Co., Chicago, Ill.
Western Electric Co., Chicago, Ill.
Ziegler Electric Co., Boston, Mass.
Manhattan Electrical Supply Co., New York
Wilcox, L. M., Newark, N. J.

Battery Jars.
Butler Hard Rubber Co.. New York
Colgate Co., Geo. L., New York
Law Battery Co., New York
New England Pottery Co., Boston, Mass.
Newton Rubber Works, Newton Upper Falls, Mass.
Goodyear Hard Rubber Co. and India Rubber Comb Co. New York,
Goodrich Hard Rubber Co., Akron, O.
Goodyear Vulcanite Co., New York
Brookfield, Wm., New York
Composite Cell Co., Brooklyn, N. Y.
Huntington Glass Co., Huntington, W. Va.
Salem Glass Works, Salem, N. J.
Thill's Sons Co., F., Brooklyn, N. Y.
Whitney Glass Works, Philadelphia, Pa.
Gillinder & Sons, Philadelphia, Pa.
Canton Glass Co., Marion, Ind.

Batteries, Closed Circuit.
Blodgett Bros. & Co., Boston, Mass.
Gordon-Burnham Battery Co., New York
d'Infreville, George, New York
Law Battery Co., New York
White Dental Mfg. Co., S. S., Philadelphia, Pa.
De Mott Motor Co., New York
Edison Mfg. Co., New York
Franklin Electrical Co., Cincinnati, O.
Union Electric Works, Chicago, Ill
Gordon-Burnham Co., New York

Batteries, Dry.
Bogart, A. L., New York
Manhattan Electrical Supply Co., New York
Eureka Tempered Copper Co., North East, Pa.
Miamisburg Electric Co., Miamisburg, O.
Bunnell & Co., J. H., New York
Greeley & Co., The E. S., New York
Western Electric Co., Chicago, Ill.
Himmer, Vitalis, New York
Partrick & Carter Co., Philadelphia, Pa.

Batteries, Open Circuit.
Blodgett Bros. & Co., Boston, Mass.
Bogart, A. L., New York
Holtzer-Cabot Electric Co., Boston, Mass.
Jones & Son, J. New York
Law Battery Co., New York
Ostrander & Co., W. R., New York
Peru Electric Mfg. Co., Peru, Ind.
Taylor & Clark, Philadelphia, Pa.
Partrick & Carter Co., Philadelphia, Pa.
White Dental Mfg. Co., S. S., Philadelphia, Pa.
Boston Electric Co., Boston, Mass.
Bunnell & Co., J. H., New York
d'Infreville, Geo., New York
Electric Mfg. and Supply Co., Pittsburgh, Pa.
Greeley & Co., The E. S., New York
Miamisburg Electric Co., Miamisburg, O.
Gordon-Burnham Battery Co., New York
Watson & Co., R. B., Detroit, Mich.
Electric Gas-Lighting Co., Boston, Mass.
Galvano-Faradic Mfg. Co., New York
Hirlimann, C. J., New York
Leclanche Battery Co., New York
National Electrical Mfg. Co., Milford, Conn.
Western Electric Co., Chicago, Ill.
Manhattan Electrical Supply Co., New York

Batteries, Medical.
Law Battery Co., New York
Ostrander & Co., W. R., New York
Hall & Son, Thos , Boston, Mass.
Pearson, Jas. J., New York
Otto & Sons, F. G , Jersey City, N. J.
Partrick & Carter Co., Philadelphia, Pa.
Bunnell & Co., J. H., New York
Flemming, Otto, Philadelphia, Pa.
McIntosh Battery and Optical Co., Chicago, Ill.
Vetter & Co., J. C., New York
Williams, P. G., New York
Galvano-Faradic Mfg. Co., New York
Waite & Bartlett Mfg. Co., New York

Batteries, Storage.
Bradbury-Stone Electric Storage Co., Lowell, Mass.
Electric Storage Battery Co., Philadelphia, Pa.
Electric Power Storage Co., New York
Ohio Storage Battery Co., Cleveland, O.
Taylor & Clark, Philadelphia, Pa.
Syracuse Storage Battery Co., Syracuse, N. Y.
American Battery Co., Chicago, Ill.
Consolidated Electric Storage Co., New York
Detroit Storage Battery Co., Detroit, Mich.
Donaldson-Macrae Electric Co., Baltimore, Md.
Eureka Electric Co., San Francisco, Cal.
Eastern Electric Light & Storage Co., Lowell, Mass.
Frank & Kilby Electric Co., Boston, Mass.
Storage Battery Supply Co., New York
P. W. Storage Battery Co., Cleveland, O.
Hasehke & Creelman, Chicago, Ill.
Hess Storage Battery Co., Philadelphia, Pa.
Standard Electric Co., Detroit, Mich.

Bells, Electric.
Partrick & Carter Co., Philadelphia, Pa.
Baxter, H. E. & C., Brooklyn, N. Y.
Blodgett Bros. & Co., Boston, Mass.
Edwards & Co., New York
Holtzer-Cabot Electric Co., Boston, Mass.
Huebel & Manger, Brooklyn, N. Y.
Jones & Son, J., New York
Novelty Electric Co., Philadelphia, Pa.
Ostrander & Co., W. R , New York
Plumb Electrical Works, Charles, Buffalo, N. Y.
Varley Duplex Magnet Co., New York
Greeley & Co., The E. S., New York
Proctor-Raymond Electric Co.. Rochester, N. Y.
Stanley & Patterson, New York
Partrick & Carter Co., Philadelphia, Pa.
Bunnell & Co., J. H., New York
Pearce, Frederick, New York
Zimdars & Hunt, New York
Manhattan Electrical Supply Co., New York

Belting.
National Leather Belting Co., New York.
New York Belting Co., New York.
Laurence, A. B., New York.
Shultz Belting Co., St. Louis, Mo.

Bells, Magneto.
Holtzer-Cabot Electric Co., Boston, Mass.
Ostrander & Co., W. R., New York
Armature Bell Co., Newark, N. J.
Western Electric Co., Chicago, Ill.
Manhattan Electrical Supply Co., New York
Utica Fire Alarm Telegraph Co., Utica, N. Y.

Blasting Apparatus.
Ætna Powder Co., Chicago, Ill.
Atlantic Dynamite Co., New York
California Cap Co., San Francisco, Cal.
Ingersoll-Sargent Drill Co., New York
Laflin & Rand Powder Co., New York
Macbeth & Co. James, New York
Rendrock Powder Co., New York

Boilers.
Clonbrock Steam Boiler Co., Brooklyn, N. Y.
Abendroth & Root Mfg. Co., New York
Robb Engineering Co., Amherst, N. S.

Brass (Sheets, Rods and Tubes).
Ansonia Brass and Copper Co., New York
Steele & Johnson Mfg. Co., Waterbury, Conn.
Wallace & Sons, New York.
Benedict & Burnham Mfg. Co., New York
Forest City Brass Works, Cleveland, O.
Holmes, Booth & Haydens, New York
Williams & Son, E. A., Jersey City, N. J.

Brushes, Motor and Dynamo.
Ansonia Brass and Copper Co., New York
Electro-Dynamic Co., Philadelphia, Pa.
Manhattan General Construction Co., New York
Crouse-Tremaine Carbon Co., Fostoria, O.
Chapin, C. E., New York
Andrae, Julius, Milwaukee, Wis.
Bolton Carbon Mfg. Co., Tonawanda, N. Y.
Belknap Motor Co., Portland, Me.
Eureka Tempered Copper Co., North East, Pa.
General Electric Company, Schenectady, N. Y.
National Carbon Co., Cleveland, O.
Partridge Carbon Co., Sandusky, O.
Solar Carbon and Mfg. Co., Pittsburgh, Pa.
Washington Carbon Co., Washington, Pa.
Wirt, Charles, Chicago.
Wisconsin Electrical Construction Co., Milwaukee, Wis.
Boudreaux Dynamo Brush Co., New York

Bushings.
American Hard Fibre Co., Newark, Del.
Butler Hard Rubber Co., New York
Delaware Hard Fibre Co., Wilmington, Del.
Kartavert Mfg. Co., Wilmington, Del.
Goodrich Hard Rubber Co., Akron, O.
Interior Conduit and Insulation Co., New York
Johns Mfg Co., H. W., New York
Dayton Mfg Co., Dayton, O.

Buttons, Push.
Delaware Hard Fibre Co., Wilmington, Del.
Edwards & Co., New York
Huebel & Manger, Brooklyn, N. Y.
Jones & Son, J., New York
Novelty Electric Co., Philadelphia, Pa.
Ostrander & Co., W. R., New York
Proctor-Raymond Electric Co., Rochester, N. Y.
Dickinson Hard Rubber Co., Springfield, Mass.
Manhattan Electrical Supply Co., New York
Stanley & Patterson, New York
Boston Electric Co., Boston, Mass.
Partrick & Carter Co., Philadelphia, Pa.
Sheble & Patton, Ltd., Philadelphia, Pa.
Bunnell & Co., J. H., New York

Carbons, Arc Light.
Brush Carbon Co., Cleveland, O.
Crouse-Tremaine Carbon Co., Fostoria, O.
American Carbon Co., Dayton, O.
Boulton Carbon Mfg. Co., Tonawanda, N. Y.
Faraday Carbon Co., Jeannette, Pa.
Phœnix Carbon Mfg. Co., St. Louis, Mo.
Thomson-Houston Carbon Co., Fremont, O.
Globe Carbon Co., Ravenna, O.
National Carbon Co., Cleveland, O.
Standard Carbon Co., Cleveland, O.
Washington Carbon Co., Pittsburgh, Pa.

Carbons, Battery.
Electrical Fibre Carbon Co., Detroit, Mich.
Peru Electric Mfg. Co., Peru, Ind.
New York Carbon Works, New York.
Partridge Carbon Co., Sandusky, O.
Solar Carbon and Mfg. Co., Pittsburgh, Pa.
Standard Carbon Co., Cleveland, O.

Cars.
Brill Co., J. G., Philadelphia, Pa.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
American Car Co., St. Louis, Mo.
Barney & Smith Car Co., Dayton, O.

Castings, Iron.
Morris, Tasker & Co., Philadelphia, Pa.
Clum & Co., P. A., Rochester, N. Y.
Trenton Malleable Iron Co, Trenton, N. J.
Arcade Malleable Iron Co., Worcester, Mass.
Bass Foundry and Machine Works, Fort Wayne, Ind.
Jonson Engineering and Foundry Co., New York
Lane's Foundry and Machine Works, Huntingdon, Pa.
Sessions Foundry Co., Bristol, Conn.
White Mfg. Co., New York
Williams & Son, E. A., New York
Fulton Foundry and Machine Works, Brooklyn, N. Y.
Lynn Foundry and Mfg. Co., Boston, Mass.
Palmer & De Mooy Foundry Co., Cleveland, O.
Robb Engineering Co., Amherst, N. S.

Castings, Aluminum.
Haight & Clark, Albany, N. Y.

Pittsburgh Reduction Co., Pittsburgh, Pa.
Ryan & Co., J. J., Chicago, Ill.
Waldo & Stout, Bridgeport, Conn.
Williams & Son, E. A., Jersey City, N. J.

Castings Brass.

Ansonia Brass and Copper Co., New York
Clum & Co., P. A., Rochester, N. Y.
Dangler Stove and Mfg. Co., Cleveland, O.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
Carter & Co., J. D., Wilmington, Del.
Crown Smelting Co., Chester, Pa.
Haight & Clark, Albany, N. Y.
Jonson Engineering & Foundry Co., New York
Steele & Johnson Mfg., Co., Waterbury, Conn.
Williams & Son, E. A., Jersey City, N. J.
Lynn Foundry and Mfg. Co., Boston, Mass.
Sioux City Brass Works, Sioux City, Iowa
Robb Engineering Co., Amherst, N. S.

Cleats, Insulating.

Imperial Porcelain Works, Trenton, N. J.
Empire China Works, Brooklyn, N. Y.
Knowles, C. S., Boston, Mass.
Peru Electric Mfg. Co., Peru, Ind.
Buffinton, E. W., Fall River, Mass.
Conover Iusulator Co., Cincinnati, O.
Hammond Cleat and Insulator Co., Boston
Pass & Seymour, Syracuse, N. Y.
Nashold Cleat Co., Chicago

Clocks, Electrical.

Ostrander & Co., W. R., New York
Howard Electric Watch and Clock Co., Boston
Standard Electric Time Co., New Haven, Conn.
Self-Winding Clock Co., New York

Chemicals.

Overbrook Chemical Co., Philadelphia, Pa.
Eimer & Amend, New York
Innis & Co., New York
Law Battery Co., New York
Klipstein & Co., A., New York
Roessler & Hasslacher Chemical Co., New York
Zinsser & Co., Wm., New York
Zucker & Levett & Loeb Co., New York
Nichols Chemical Co., New York

Circuit Breakers.

Electric Engineering and Supply Co., Syracuse, N. Y.
Allen Electric and Supply Co., Philadelphia, Pa.
Anderson, Albert & J. M., Boston, Mass.
Macallen & Co., W. T. C., Boston, Mass.
Pass & Seymour, Syracuse, N. Y.
Cutter Electrical and Mfg Co., Philadelphia, Pa.

Conduits, Underground.

National Conduit Mfg. Co., New York
Cummings & Engleman Conduit Co., Detroit
Fiberite Co., Mechanicsville, N. Y.
General Electric Co., Schenectady, N. Y.
Lehigh Valley Creosoting Co., Perth Amboy, N J.

Connectors, Terminals, Etc.

McIntire Co., C., Newark, N. J.
Shawmut Fuse Wire Co., Boston, Mass.

Controllers, Railway Motor.

Card Electric Co., Mansfield, O.
Card Electric Motor and Dynamo Co., Cincinnati, O.
General Electric Co., Schenectady, N. Y.
Walker Mfg. Co., Cleveland, O.
Westinghouse Elec. and Mfg. Co., Pittsburgh, Pa

Clocks, Watchman's.

Partrick & Carter Co., Philadelphia, Pa.
Edwards & Co., New York
Holtzer-Cabot Electric Co., Boston, Mass.
Jones & Son, J., New York
Novelty Electric Co., Philadelphia, Pa.
Bundy Mfg. Co., Binghamton, N. Y.
Schaffer & Budenberg, Brooklyn, N. Y.
Ziegler Electric Co., Boston, Mass.
American Watchman's Time Detector Co., New York
Eco Magneto Clock Co., Boston, Mass.
Ongley Electric Co., Hoboken, N. J.
Cleveland Electrical Mfg. Co., Cleveland, O.
Manhattan Electrical Supply Co., New York

Compounds, Preservative.

Standard Paint Co., New York
Morris & MacCurdy, Indianapolis, Ind.

Condensers, Electric.

Marshall, Wm., New York

Conduits, Interior.

American Circular Loom Co., Chelsea, Mass.
Interior Conduit and Insulation Co., New York.

Coppers for Battery.

Jones & Son, J., New York
Law Battery Co., New York
Manhattan Electrical Supply Co., New York
Edes Mfg. Co., Plymouth, Mass.
Partrick & Carter Co., Philadelphia, Pa.
Western Electric Co., Chicago and New York.

Copper, Tempered.

Forest City Electric Works, Cleveland, O.
Eureka Tempered Copper Co., North East, Pa.

Cord, Flexible.

Ansonia Brass and Copper Co., New York
Bishop Gutta-Percha Co., New York
Moore, Alfred F., Philadelphia, Pa.
Okonite Co., Ltd., New York
Safety Insulated Wire and Cable Co., New York
American Electrical Works, Providence, R. I.
National India Rubber Co., Bristol, R. I.
Washburn & Moen Mfg. Co., Worcester, Mass.
Godfrey, J. W., New York

Cut-Outs, Arc Light.

Ft. Wayne Electric Co., Ft. Wayne, Ind.
Bernard Co., E. G., Troy, N. Y.
Standard Electric Co., Chicago, Ill.
Bryant Electric Co., Bridgeport, Conn.
Hope Electric Appliance Co., Providence, R. I.
Pass & Seymour, Syracuse, N. Y.
Utica Electric Mfg. and Supply Co., Utica, N. Y.
Western Electric Co., Chicago, Ill.

Cut-Outs, Automatic Magnetic.

Cutter Electric and Mfg. Co., Philadelphia.
General Electric Co., New York.

Cut-Outs, Incandescent.

Butler Mfg. Co., Chicago, Ill.
Colgate & Co., Geo. L., New York
Elec. Engineering and Supply Co., Syracuse, N. Y.
Gleason Mfg. Co., E. P., New York
Perkins Electric Switch Mfg. Co., Hartford, Conn.
Paiste Co., H. T., Philadelphia, Pa.
Partrick & Carter Co., Philadelphia, Pa.
Emerson Electric Mfg. Co., St. Louis, Mo.
Peru Electric Mfg. Co., Peru, Ind.
Hays & Co., J. L., Pittsburgh, Pa.
Hammond Cleat and Insulator Co., Boston, Mass.
Cutler-Hammer Mfg. Co., Chicago, Ill.
Linton & Southwick, Worcester, Mass.

Cut-Outs, Motor.

Electric Selector and Signal Co., New York
Electric Eng. & Supply Co., Syracuse, N. Y.
Pass & Seymour, Syracuse, N. Y.
Sioux City Brass Works, Sioux City, Ia.

Commutators.

Elliott-Lincoln Electric Co., Cleveland, O.
Eureka Tempered Copper Co., North East, Pa.
Steel Motor Company, Cleveland, O.
Taylor-Belding Electric Co., Chicago, Ill.
Pogue, Chas. J., New York
Stucky & Heck, Newark, N. J.

Commutator Bars.

Ansonia Brass and Copper Co., New York
Billings & Spencer Co., Hartford, Conn.
Eureka Tempered Copper Co., North East, Pa.
Williams & Son, E. A., Jersey City, N. J.
I X L Tempered Copper Co., Buffalo, N. Y.
Sioux City Brass Works, Sioux City, Ia.
Forest City Electric Works, Cleveland, O.

Compounds, Insulating.

Belden Mica Mining Co., F. E., Boston, Mass.
Childs Mfg. Co., New York.
Standard Paint Co., New York
Morris and MacCurdy, Indianapolis, Ind.

Cord Adjusters.

Delaware Hard Fibre Co., Wilmington, Del.
Electric Eng. & Supply Co., Syracuse, N. Y.
McCreary, A. A., New York, N. Y.
Blair Lamp Adjuster Co., Omaha, Neb.
Boston Electric Co., Boston, Mass.
Dow Adjuster Co., Braintree, Mass.
Goodrich Hard Rubber Co., Akron, Ohio

Cross Arms.

Lock & Co., Fred. M., Victor, N. Y.
Morris, Tasker & Co., Ltd., Philadelphia, Pa.
Chicago Cross-Arm Co., Chicago
Star Iron Tower Co., Fort Wayne, Ind.
Lefmann, Julius, St. Louis, Mo.
Loud & Sons Lumber Co., H. M., Oscoda, Mich.
Ripley, Henry C., East Saginaw, Mich.

Dies, Presses, Etc.

Prentiss Tool and Supply Co., New York
Bliss Co., E. W., Brooklyn, N. Y.
Ferracute Machine Co., Bridgeton, N. J.
Gould & Eberhardt, Newark, N. J.
Jones, W. E., Brooklyn, N. Y.
Newark Machine Tool Works, Newark, N. J.
Watson & Stillman, New York
Garvin Machine Co., New York

Disks, Armature.

Colgate & Co., Geo. L., New York
Ely & Williams, Philadelphia, Pa.
Winckler, E. E., New York
Smith & Co., Thos., Worcester, Mass.

Drills, Portable.

Electro-Dynamic Co., Philadelphia, Pa.
Dallett & Co., Thos. H., Philadelphia, Pa.

Dynamos. (See Motors and Dynamos.)

Door Openers, Electric.

Edwards & Co., New York
Ostrander & Co., New York
Bunnell & Co., J. H., New York
Manhattan Electrical Supply Co., New York
Partrick & Carter Co., Philadelphia
Sieb & Starke, New York

Electric Light Portables.

McCreary, A. A., New York
McLeod, Ward & Co., New York

Electro-Plating Apparatus.

Eddy Electric Mfg. Co., Windsor, Conn.
Columbus Electrical Machine Works, Columbus, Ohio.
Hall & Son, Thos., Boston, Mass.
Hanson & Van Winkle Co., Newark, N. J.
Palmer Bros, Mianus, Conn.
Colburn Electric Mfg. Co., Fitchburg, Mass.
Zucker & Levett & Loeb Co., New York
Mayer, M. M., New York.

Elevators, Electric.

Keystone Electric oC., Erie, Pa.
Otis Bros. & Co., New York
Elektron Mfg. Co., Springfield, Mass.
Graves Elevator Co., Rochester, N. Y.
Morse, Williams & Co., Philadelphia, Pa.
See Mfg. Co., A. B., Brooklyn, N. Y.
Sprague Electric Elevator Co., New York

Engines, Gas.

Olin Gas Engine Co., Buffalo, N. Y.
Wattles, C. B., Elizabeth, N. J.
Backus Mfg. Co., Newark, N. J.
Caldwell & Sons, H. W., Chicago, Ill.
Charter Gas Engine Co., Sterling, Ill.
Otto Gas Engine Works, Philadelphia, Pa.
Rollason Gas Engine Co, New York
Springfield Gas Engine Co., Springfield, O.
Weber Gas and Gasoline Engine Co., Kansas City, Mo.
White & Middleton Gas Engine Co., Baltimore, Md.

Engines, Steam.

Allis Co., Edward P., Milwaukee, Wis.
Altoona Mfg Co., Altoona, Pa.
American Engine Co., Bound Brook, N. J.
Armington & Sims Engine Co., Providence.
Ball & Wood Co., New York
Buckeye Engine Co., Salem, O.
Case Engine Co., J. T., New Britain, Conn.
Clark Brothers, Belmont, N. Y.
Corliss Steam Engine Co., Providence, R. I.
Erie Engine Works, Erie, Pa.
Erie City Iron Works, Erie, Pa.
Fishkill Landing Machine Co., Fishkill, N. Y.
Robb Engineering Co., Amherst, N. S.
Stearns Mfg Co., Erie, Pa.
Straight Line Engine Co., Syracuse, N. Y.
Taylor Engine Co., Chambersburg, Pa.
Watertown Steam Engine Co., Watertown, N. Y.
Westinghouse Machine Co., Pittsburgh, Pa.

Fans, Ceiling.

Diehl & Co., New York.
Holtzer-Cabot Co., Boston.
Dayton Fan Motor Co., Dayton, O.
McLeod, Ward & Co., New York.
Emerson Electric Mfg. Co., St. Louis, Mo.
Crocker-Wheeler Electric Co., New York.
Interior Conduit and Insulation Co., New York.
Crescent Electric Co., Lancaster, Pa.

Fans, Exhaust.

Garden City Fan Co., Chicago, Ill.
Andrews & Johnson, Chicago, Ill.
Barney Ventinating Fan Co., Boston, Mass.
Davidson Ventilating Fan Co., Boston, Mass.
Howard & Morse, New York.
Huyett & Smith Mfg. Co., Detroit, Mich.
Wing & Co., L. J., New York.

Fenders, Car.

Peckham Motor, Truck and Wheel Co., New York.
Fulton Truck and Foundry Co., Cleveland, O.
Crawford Mfg Co., R. A., Pittsburgh, Pa.
Field Life Guard Co., Providence, R. I.
Robbins Life Guard and Mfg. Co., Philadelphia, Pa.
Sterling Supply and Mfg. Co., New York.
U. S. Street Car Fender Co., New York.

Fixtures, Electric and Gas.

Horn, Brannen & Forsyth Mfg. Co., Philadelphia, Pa.
McCreary, A. A., New York
Acme Gas Fixture Co., Philadelphia, Pa.
Buck, Son & Co., W. J., Philadelphia, Pa.
Cassidy & Son Mfg. Co., New York.
General Fixture Co., New York.
Thackara Mfg. Co., Philadelphia, Pa.
Vosburgh Mfg. Co., Ltd, W. C., Brooklyn and Chicago.

Fuse Wire.

General Electric Co., Schenectady, N. Y.
Independent Electric Co., Chicago, Ill.
Jersey City Smelting Works, Jersey City, N. J.
Shawmut Fuse Wire Co., Boston, Mass.
Western Electric Co., Chicago, Ill.

Gas Lighters, Electric.

Bogart, A. L., New York
Edwards & Co., New York
Holtzer-Cabot Electric Co , Boston, Mass.
Novelty Electric Co., Philadelphia, Pa.
Ostrander & Co., W. R., New York
Parke & Co., John Y., Philadelphia, Pa.
Electric Gas Lighting Co., Boston, Mass.
Partrick & Carter Co., Philadelphia, Pa.
Cleverly Electrical Works, Philadelphia, Pa.
Manhattan Electrical Supply Co., New York

Generators, Power.

Claus, P., New York.
Eddy Electric Mfg. Co., Windsor, Conn.
Brush Electric Co., Cleveland, O.
Fisher Electric Mfg Co., Detroit, Mich.
Royal Electri c Co., Peoria, Ill.
C. & C. Electric Co., New York
Detroit Motor Co., Detroit, Mich.
Fort Wayne Electric Co., Fort Wayne, Ind.
General Electric Co., Schenectady, N. Y.
Mather Electric Co., Manchester, Conn.
Waddell-Entz Co., New York.
Walker Mfg. Co., Cleveland, O.
Westinghouse Electric and Mfg. Co.,Pittsburgh,Pa.
Western Electric Co., Chicago, Ill.
Jenney Electric Motor Co., Indianapolis, Ind.

Globes, Shades, Etc.

Gill & Co., Philadelphia, Pa.
Gleason Mfg. Co., E. P., New York
McCreary, A. A., New York
Murray & Co., James J., Philadelphia, Pa.
Phœnix Glass Co., New York
Huntington Glass Co., Huntington, W. Va.
Libbey Glass Co., Toledo, O.
Mt. Washington Glass Co., New Bedford, Mass.
Thill's Sons & Co., F., Brooklyn, N. Y.
Utility Shade Co., New York.
U. S. Glass Co., Pittsburgh, Pa.
Gillinder & Sons, Philadelphia, Pa.

Gongs, Electro-Mechanical.

Partrick & Carter Co., Philadelphia.
Holtzer-Cabot Electric Co., Boston, Mass.
Novelty Electric Co., Philadelphia, Pa.
Boston Electric Co., Boston, Mass.
Edwards & Co., New York.

Gauges, Pressure Recording.

Crosby Steam Gauge and Valve Co., Boston, Mass.
Bristol Co., Waterbury, Conn.
Schaffer & Budenberg, Brooklyn, N. Y.
Edson, Jarvis B., New York
Sherwood Mfg. Co., Buffalo, N. Y.

Heaters, Electric.

Hunt, H. H , Boston, Mass.
Victor El c rical Co., Cleveland, O.
American Electric Heating Corporation, Boston, Mass.
American Electiic Heater Co., Detroit, Mich.
Central Electric Heating Co., New York
Consolidated Car Heating Co., Albany, N. Y.
New England Electric Heating Co., Boston, Mass.
Reliable Mfg. Co., Boston, Mass.
Western Electric Heating Co., Chicago, Ill.

Hangers, Arc Lamp.

Butler Mfg. Co., Chicago, Ill.
Fletcher Mfg. Co., Dayton, O.
Western Electric Co., Chicago, Ill.
Macallen & Co., W. T. C., Boston, Mass.
Johns Mfg Co., H. W., New York.

Hangers, Cable.

Bender & Co., O. N., Providence, R. I.
Western Electric Co., Chicago, Ill.
Johns Mfg. Co., H. W., New York

Hoods for Arc Lamps.

McLeod, Ward &Co., New York.
Elec. Eng. & Supply Co., Syracuse, N. Y.
Butler Electric Co., Chicago.

Insulators, Fibre.

Vulcanized Fibre Co., New York
Laminar Fibre Co., Boston, Mass.

Insulators, Glass.

Locke & Co., Fred. M., Victor, N. Y.
Brookfield, Wm., New York
Hemingray Glass Co., Covington, Ky.
Boston Insulator Co., Boston, Mass.
Oakman Mfg. Co., Boston, Mass.
Peru Electric Mfg. Co., Peru, Ind.

Insulators, Lava.

Steward Mfg. Co.. D. M., Chattanooga, Tenn.
Hinds, Chas. S., New York.

Insulators, Mica.

Mica Insulator Co., New York
Silis, W. H., Chicago, Ill.
Macallen & Co., W. T. C., Boston, Mass.
Johns Mfg. Co., H. W., New York
Schoonmaker, A. O., New York
Belden Mica Co., F. E., Boston, Mass.
Munsell & Co., New York.

Insulators, Porcelain.

Imperial Porcelain Works, Trenton, N. J.
Conover Insulator Co., Cincinnati, O.
Hammond Cleat and Insulator Co., Boston
Pass & Seymour, Syracuse, N. Y.
McLeod, Ward & Co., New York.
Trimble Patent Insulator Co., Baltimore, Md.
Union Porcelain Works, Brooklyn, N. Y.
Peru Electric Mfg. Co., Peru, Ind.
Empire China Works, Brooklyn, N. Y.

Insulators, Rubber.

Butler Hard Rubber Co., New York
Goodyear Hard Rubber Co., and India Rubber Comb Co., New York
Goodrich Hard Rubber Co., Akron, O.

Insulators, Trolley.

Electric Engineering and Supply Co., Syracuse, N.Y.
Fiberite Co., Mechanicsville, N. Y.
Johns Mfg. Co., H. W., New York
New York Electrical Works, New York
Schefbauer, R., Paterson, N. J.
Wales Mfg. Co., Syracuse, N. Y.
Mica Asbetite Insulating Co., Chicago

Instruments, Measuring and Testing.

Colgate Co., Geo. L., New York
Electric Engineering and Supply Co., Syracuse, N. Y.
Electro-Dynamic Co., Philadelphia
Law Battery Co., New York
Ritchie & Sons, E. S., Brookline, Mass.
Weston Electrical Instrument Co., Newark, N. J.
Bunnell Co., J. H., New York
Whitney Electrical Instrument Co., Penacook, N. H.
Ziegler Electric Co., Boston, Mass.
Bristol Company, Waterbury, Conn.
Edison Mfg. Co., New York
Greeley & Co., The E. S., New York
Western Electric Co., Chicago, Ill.
Westinghouse Electric and Mfg. Co., Pittsburgh, Pa.
Wirt, Charles, Chicago

Instruments, Telegraph.

Partrick & Carter Co., Philadelphia, Pa.
Plumb Electrical Works, Chas., Buffalo, N. Y.
Bunnell & Co., J. H., New York
Greeley & Co., The E. S., New York
Moses, I. H., Cleveland, O.
Pearce, Frederick, New York

Lamps, Arc.

Auerbach Woolverton Electric Co., Hoboken, N.J.
Bramhall, Chas. A., New York.
Clark Electric Co., New York
Helios Electiic Co., Philadelphia. Pa.
Imperial Electric Lamp Co., New York
General Incandescent Arc Light Co., New York
Ball Electric Light Co., New York
Brush Electric Co., Cleveland, O.
Fort Wayne Electric Co., Fort Wayne, Ind.
General Electric Co. Schenectady, N. Y.
Scott Electric Lamp Co., New York
Standard Thermometer Co., Peabody, Mass.
Standard Electric Co., Chicago, Ill.
Western Electric Co., Chicago, Ill.
Manhattan General Const. Co , New York
Solar Arc Lamp Co., Brooklyn, N. Y.

Lamps, Focussing.

Scott Electric Lamp Co., New York.
Corey, R. B., New York.
Colt, J. B. & Co., New York.

Lamps, Search.

Scott Electric Lamp Co., New York.
General Electric Co., Schenectady, N. Y.
Corey, R. B., New York.

Lamps, Incandescent.

Automatic Electrical Specialty Co., Inc., New York.
Beacon Vacuum Pump and Electrical Co., Boston, Mass.
Colgate Co , Geo. L., New York
Jaeger Electric Lamp Co , New York.
Sunbeam Lamp Mfg. Co., Chicago, Ill.
American Electrical Mfg. Co., St. Louis, Mo.
Bernstein Electric Co., Boston, Mass.
Buckeye Electric Co., Cleveland, O
Carter & Co., Geo. G., Chicago, Ill.
Columbia Incandescent Lamp Co., St. Louis, Mo.
General Electric Co., Schenectady, N. Y.
Marlboro Electric Machine and Lamp Co., Marlboro, Mass.
New York and Ohio Co., Warren, O.
Universal Electric Co., Cleveland, O.
Warren Electric and Specialty Co., Warren, O.
Westinghouse Electric and Mfg. Co., Pittsburgh, Pa.
Swan Lamp Mfg. Co.. Cleveland, O.
Somoff, J. L , New York

Letter Boxes.

Ostrander & Co., W. R , New York
Manhattan Electric Supply Co., New York
Jones, J., & Son, New York.
Baxter, H. E., & C., Brooklyn, N. Y.
Huebel & Manger, Brooklyn, N. Y.

Lighting Arresters.

Colgate Co., Geo. L., New York
Van Nuis, C. S., New York
Jones Bros. Electric Co., Cincinnati, O.

Sperry Electric Railway Co., Cleveland, O.
Westinghouse Elec. and Mfg. Co., Pittsburgh, Pa.
Garton-Daniels Electric Co., Keokuk, Ia.
General Electric Co., Schenectady, N. Y.
Utica Electrical Mfg. and Supply Co., Utica, N. Y.
Western Electric Co., Chicago, Ill.
Partrick & Carter Co., Philadelphia, Pa.
Shaw, H. M., New York

Machines and Machine Tools.

Bridgeport Machine Tool Works, Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Ferracute Machine Co., Bridgeton, N. J.
Garvin Machine Co., New York
Gould & Eberhardt, Newark, N. J.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool and Supply Co., New York
Rhode Island Tool Co., Providence, R. I.
Sellers & Co., Wm., Philadelphia, Pa.

Machines, Braiding.

High Speed Braider Co., Westfield, Mass.
New England Butt Co., Providence, R. I.
Rhode Island Braiding Machine Co., Providence R. I.

Motors and Dynamos.

Holtzer-Cabot Electric Co., Boston, Mass.
Jones & Son, J., New York
Keystone Electric Co., Erie, Pa.
Otis Bros. & Co., New York
Storey Motor and Tool Co., New York
Ball Electric Light Co., New York
Belknap Motor Co., Portland, Me.
Brush Electric Co., Cleveland, O.
C. & C. Electric Co., New York
Claus P., New York
Crocker-Wheeler Electric Co., New York
Dallett & Co., Thos. H , Philadelphia, Pa.
Detroit Motor Co., Detroit, Mich.
Elektron Mfg. Co., Springfield, Mass.
Excelsior Electric Co., New York
Fort Wayne Electric Co., Fort Wayne, Ind.
General Electric Co., Schenectady, N. Y.
Hyer-Sheehan Electric Motor Co., Newburgh, N.Y.
Interior Conduit and Insulation Co., New York
La Roche Electric Works, Philadelphia, Pa.
Mather Electric Co., Manchester, Conn.
Mayer, M. M., New York
Riker Electric Motor Co., Brooklyn, N. Y.
Royal Electric Co., Peoria, Ill.
Standard Electric Co., Chicago, Ill.
Stanley Electric Mfg. Co., Pittsfield, Mass.
Western Electric Co., Chicago, Ill.
Westinghouse Electric and Mfg. Co., Pittsburgh, Pa.
Crescent Electric Machinery Co., Brooklyn, N. Y.
Electro-Dynamic Co., Philadelphia, Pa.
Fontaine Crossing and Electrical Co., Detroit, Mich.
Wachtel, Charles, Newark, N. J.
Warfield, L., Detroit, Mich.
Walker Mfg Co., Cleveland, O.
Jenney Electric Co., Indianapolis, Ind.
Clark Electric Co., New York
Pearce, F. R., New York.
Diehl & Co., New York
Eddy Electric Mfg. Co., Windsor, Conn.

Motors, Electric Railway.

General Electric Co., Schenectady, N. Y.
Card Electric Co., Mansfield, O.
Sperry Electric Railway Co., Cleveland, O.
Steel Motor Co., Cleveland, O.
Westinghouse Electric and Mfg. Co.,Pittsburgh,Pa.
Card Electric Motor and Dynamo Co., Cincin'ti, O.
Walker Mfg. Co., Cleveland, O.

Motors, Fan.

Colgate Co., Geo. L., New York
Diehl & Co., New York.
Holtzer Cabot Electric Co., Boston, Mass.
Novelty Electric Co. Philadelphia, Pa.
C. & C. Electric Co., New York
Crocker-Wheeler Electric Co , New York
Dayton Fan and Motor Co., Dayton, O.
De Mott Motor Co , New York
Edison Mfg. Co., New York
General Electric Co., Schenectady, N. Y.
Interior Conduit and Insulation Co., New York
Emerson Electric Mfg. Co., St. Louis, Mo.
Armature Bell Co., Newark, N. J.
Electro Dynamic Co., Philadelphia, Pa.
North American Electric Co., New York
M. & M. Electric Co., New York
Commonwealth Electric Co , Philadelphia, Pa.
Crescent Electric Co., Lancaster, Pa.
Cushman, A. L., Concord, N. H.
New Haven Insulated Wire Co., New Haven, Conn.
Standard Electric Company, Pittsburgh, Pa.

Magnets.

Varley Duplex Magnet Co., New York
Manhattan Electrical Supply Co., New York
Splitdorf, C. F., New York
Bunnell & Co., J. H., New York

Mica.

Mica Insulator Co., New York
Munsell & Co., Eugene, New York
American Mica Co., Boston, Mass.
Belden Mica Mining Co., F. E., Boston, Mass.
Randall Mica Co., Charles L., Boston, Mass.
Schoonmaker, A. O., New York

Mast Arms.
Kim, Geo. M., Allegheny, Pa.
Creaghead Engineering Co., Cincinnati, O.
Brady, Thos. H., New Britain, Conn.
Dillon Mast-Arm Co., Indianapolis, Ind.

Oils.
Reliance Oil and Grease Co., Cleveland, O.
Smith & Nicholls, New York
Stuart & Co., D. A., Chicago, Ill.
Taussig, S., Chicago, Ill.
Wadhams Oil and Grease Co., Milwaukee, Wis.

Paints, Insulating.
Standard Paint Co , New York
Campbell Electric Supply Co., Boston, Mass.
Johns Mfg. Co., H. W., New York
Paragon Insulating Co., Cleveland, O.
Morris & MacCurdy, Indianapolis, Ind.

Platinum.
Schawel & Co., Jas., New York
Baker & Co., Newark, N. J.
Platt, C. S. New York

Poles, Iron and Steel.
Morris, Tasker & Co., Philadelphia, Pa.
Simmons Co., John, New York
Walworth Mfg. Co., Boston, Mass.

Poles, Trolley.
Anderson, A. &. J. M., Boston, Mass.
Steel Motor Co., Cleveland O.
Nuttall Co., R. D., Allegheny, Pa.

Porcelain.
Imperial Porcelain Works, Trenton, N. J.
Century Pottery Co., Camden, N. J.
Empire China Works, Brooklyn, N. Y.
Hammond Cleat and Insulator Co., Boston, Mass.
Pass & Seymour, Syracuse, N. Y.
Union Porcelain Works, Brooklyn, N. Y.

Pumps, Electric.
Otis Bros. & Co., New York
Worthington, H. R., New York.
Goulds Mfg. Co., Seneca Falls, N. Y.
Blake, G. F. & Co., New York.

Pumps, Vacuum.
Beacon Vacuum Pump and Electrical Co., Boston, Mass.
Hubbard, Norman, Brooklyn, N. Y.

Rail Bonds.
Hunt, H. H., Boston, Mass.
New York Electrical Works, New York
Roebling's Sons Co., John A., Trenton, N. J.
Benedict & Burnham Mfg. Co., New York
Wallace & Sons, New York
Anderson, Albert & J. M., Boston, Mass.
Washburn & Moen Mfg. Co., Worcester, Mass.

Reflectors.
Gleason Mfg. Co., E. P., New York
Klemm & Co., Philadelphia, Pa.
McCreary, A. A., New York
Smith of New York, New York
Wheeler Reflector Co , Boston, Mass.
McLeod, Ward & Co., New York
Fink, I. P., New York
Klein, P. J., New York

Regulators, Temperature.
Novelty Electric Co., Philadelphia, Pa.
Butz Temperature Regulating Co., Chicago, Ill.
Compton Electric Service Co., New York
Electric Thermostat Co., Minneapolis, Minn.
Thermo-Electric Heat Regulating Co., Easton, Pa.
Howard Thermostat Co., New York

Resistance Coils.
Bunnell & Co., J. H., New York
Carpenter Enamel Rheostat Co., Hoboken, N. J.
Electric Bell and Resistance Co., Newark
Partrick & Carter Co., Philadelphia, Pa.
Pearce, Fred'k, New York.

Rheostats.
Colgate Co., Geo. L., New York
Holtzer-Cabot Electric Co., Boston, Mass.
Carpen er Enamel Rheostat Co., Hoboken, N. J.
Cutler-Hammer Mfg. Co., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Gish Ideal Rheostat Co., John L., Jackson, Mich.
McDougall & Cummings, Chicago, Ill.
Washington Electric Co., Chicago, Ill.
Westinghouse Electric and Mfg. Co., Pittsburgh, Pa.
Emerson Electric Mfg. Co., St. Louis, Mo.
Brush Electric Co., Cleveland, O.
Bunnell & Co., J. H., New York
North American Electric Co., New York

Rubber, Hard.
Butler Hard Rubb r Co., New York
Goodyear Hard Rubber Co., and India Rubber Comb Co., New York
Goodrich Hard Rubber Co., Akron, O.
Goodyear Vulcanite Co , New York.
Newton Rubber Works, Newton Upper Falls, Mass.

Silk for Electrical Purposes.
Boston Braid Mfg. Co., Boston, Mass.
Eureka Silk Co., Boston, Mass.
Macfarlane & Co., Wm., New York
Ryle & Co., Wm., New York
Sauquoit Si k Mfg. Co , Philadelphia, Pa.

Sockets.
Automatic Electrical Specialty Co., Inc., New York
Colgate Co., Geo. L., New York
Dale Mfg. Co., New York
Electric Engineering and Supply Co., Syracuse, N. Y.
Iona Mfg. Co., Boston, Mass.
Anchor Electr c Co., Boston.
Perkins Electric Switch Mfg. Co., Hartford, Conn.
Bryant Electric Co , Bridgeport, Conn.
General Electric Co., Schenectady, N. Y.
Newton Electric Co., New York

Switchboards.
Electric Engineering and Supply Co., Syracuse, N. Y.
Electro-Dynamic Co., Philadelphia, Pa.
Elektron Mfg. Co., Springfield, Mass.
Herzog Teleseme Co., New York
Hill Electric Co., W. S., Boston, Mass.
Holzer-Cabot Electric Co., Boston, Mass.
McNamara Bros., Fair Haven, Vt.
Murphy, T. J., New York
Technic Electrical Works, Philadelphia, Pa.
Weston & Co., Wm. H., Philadelphia, Pa.
Belknap Motor Co., Portland, Me.
Brooklyn Electrical Mfg. Co., Brooklyn, N. Y.
Brush Electric Co., Cleveland, O.
Fort Wayne Electric Co., Fort Wayne, Ind.
General Electric Co., Schenectady, N. Y.
Hays & Co., J. L., Pittsburgh, Pa.
High & Co., J. Grant, Philadelphia, Pa.
Jenney Electric Motor Co., Indianapolis, Ind.
Partrick & Carter Co., Philadelphia, Pa.
Western Electric Co., Chicago, Ill.
Westinghouse Electric and Mfg. Co., Pittsburgh, Pa.

Switches, Automatic.
Sweet Electric & Mfg. Co., Grands Rapids, Mich.
Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.
Zimdars & Hunt, New York.

Switches, Incandescent.
Cutter Electrical and Mfg. Co., Philadelphia, Pa.
Dale Mfg. Co., Mew York
Electric Engineering and Supply Co., Syracuse, N. Y.
Herzog Teleseme Co., New York
Hill Electric Co., W. S., Boston, Mass.
Holtzer-Cabot Electric Co., Boston, Mass.
Perkins Electric Switch Mfg. Co.. Hartford, Conn.
Bryant Electric Co., Bridgeport, Conn.
General Electric Co., Schenectady, N. Y.
Hart & Hegeman Mfg. Co., Hartford, Conn.
Interior Conduit and Insulation Co., New York.
Jones Bros. Electric Co., Cincinnati, O.
Paiste, H. T., Chicago, Ill.
Pass & Seymour, Syracuse. N. Y.
Platt, O. S., Bridgeport, Conn.
Universal Electric Pull Socket and Switch Co., New York
Utica Electrical Mfg. and Supply Co., Utica, N. Y.
Westinghouse Electric and Mfg. Co., Pittsburgh, Pa.

Switches, Motor.
Elec. Eng. & Supply Co., Syracuse, N. Y.
Electric Selector and Signal Co., New York
Hill Electric Co., W. S., Boston, Mass.
Holtzer-Cabot Electric Co., Boston, Mass.
Automatic Switch Co., Baltimore, Md.
Cutler-Hammer Mfg. Co., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Linton & Southwick, Worcester, Mass.
Sperry Electric Railway Co., Cleveland, O.
Steel Motor Co., Cleveland, O.
Brush Electric Co., Cleveland, O.
Electro-Dynamic Co., Philadelphia, Pa.
Westinghouse Electric and Mfg. Co., Pittsburgh, Pa.

Switches, Station.
Cutter Electrical and Mfg. Co., Philadelphia, Pa.
Electric Engineering and Supply Co., Syracuse, N. Y.
Hill Electric Co., W. S., Boston, Mass.
Holtzer-Cabot Electric Co., Boston, Mass.
Jones & Son, J., New York.
Novelty Electric Co., Philadelphia, Pa.
Van Nuis, C. S., New York.
Brooklyn Electrical Mfg. Co., Brooklyn, N. Y.

Spark and Induction Coils.
Splitdorf, C. F., New York
International Electric Co., New York

Speaking Tubes.
Ostrander & Co., W. R., New York
Manhattan Electrical Supply Co., New York
Partrick & Carter Co., Philadelphia, Pa.
Walsh, Owen, New York
Western Electric Co., Chicago, Ill.

Trolley, Underground.
Electrical Conduit Traction Equipment Co., New York
Electric Traction Equipment Co., New York
Universal Electric Co., New York
Love Electric Traction Co., Chicago, Ill.

Tape Insulating.
Brixey, W. R., New York
Okonite Co., Ltd., New York
Standard Paint Co., New York.
National India Rubber Co., Bristol, R. I.
New York Insulated Wire Co., New York.
Knowles, C. S., Boston

Telephones.
Columbia Telephone Mfg. Co., New York
Harrison International Telephone Co., New York
National Telephone Mfg. Co., Boston, Mass.
Brown Telephone and Telegraph Co., Chicago, Ill.
Gerson Electrical Co., Philadelphia, Pa.
Interior Telephone Co , New York
Law Battery Co., New York
Phœnix Telephone Co., New York
Public Telephone Co., New York
Strowger Automatic Telephone Exchange, Chicago
Western Electric Co., Chicago, Ill.
Western Telephone Construction Co., Chicago
Manhattan Electrical Supply Co., New York
American Bell Telephone Co., Boston
American Electric-Telephone Co., Kokomo, Ind.
Automatic Telephone and Electric Co., New York
Consolidated Telephone Co., New York
De Veau & Co., New York
D'Unger Electrical Telephone Mfg. Co., Chicago
Mason Telephone Co., Richmond, Va.
Moran, Owen, New York
Electric Telephone Construction Co., Cincinnati, O.
Palmer Bros., Mianus, Conn.
Phœnix Interior Telephone Co., New York
Gilliland Telephone Co, Chicago, Ill.
Tucker Electrical Construction Co., New York
Universal Telephone Co., Indianapolis, Ind.

Transformers.
Diamond Electric Mfg. Co., Peoria, Ill.
General Electric Co., Schenectady, N. Y.
Hornberger Electric Mfg. Co., Elkhart, Ind.
Royal Electric Co., Peoria, Ill.
Stanley Electric Mfg. Co., Pittsfield, Mass.
Wagner Electric Mfg. Co., St. Louis, Mo.
Westinghouse Electric and Mfg. Co., Pittsburgh, Pa.
Adams Electric Co., Elkhart, Ind.
Packard Electric Co., Warren, O.
National Electric Co., Eau Claire, Wis.

Torches.
Burgess Soldering Furnace Co., Columbus, O.
Clayton & Lambert Mig. Co. Ypsilanti, Mich.
Dangler Stove and Mfg. Co., Cleveland, O.
Volty, C. M., St. Joseph, Mo.
Vulcan Co., New York

Telephone Booths.
Seaman & Co., Milwaukee, Wis.
American Telephone Booth Co., New York

Turntables.
Holtzer-Cabot Electric Co., Boston, Mass.
Novelty Electric Co., Philadelphia, Pa.
Pearce, Frederick, New York

Wiring Tubes.
Butler Hard Rubber Co., New York
Colgate Co., Geo. L., New York
Imperial Porcelain Works, Trenton, N. J.
Kartavert Mfg. Co., Wilmington, Del.
Mica Insulator Co., New York
Okonite Co., Ltd., New York
Akron Insulator and Marble Co., Akron, O.
Goodyear Hard Rubber Co. and India Rubber Comb Co., New York
Goodrich Hard Rubber Co., Akron, Ohio
Goodyear Vulcanite Co., New York.
Pass & Seymour, Syracuse, N. Y.
Peru Electric Mfg. Co., Peru, Ind.
Vulcanized Fibre Co., New York

Wire, Bare and Insulated.
American Electrical Works, Providence, R. I.
Ansonia Brass and Copper Co., New York
Washburn & Moen Mfg. Co., Worcester, Mass.
Benedict & Burnham Mfg. Co., Waterbury, Conn.
Bridgeport Brass Co., Bridgeport, Conn.
Holmes, Booth & Haydens, New York
Lewisohn Bros., New York
Roebling's Sons Co., John A., Trenton, N. J.
Wallace & Sons, New York
Bishop Gutta-Percha Co., New York
Brixey, W. R., New York
Colgate Co., Geo. L., New York
Eastern Electric Cable Co., Boston, Mass.
India Rubber and Gutta-Percha Insulating Co., New York
Okonite Co., Ltd., New York

Phillips Electrical Works, Ltd., Eugene F., Montreal, Que.
Phillips Insulated Wire Co., New York
Safety Insulated Wire and Cable Co., New York
American Circular Loom Co., Chelsea, Mass.
Bradford, Kyle & Co., Plymouth, Mass.
Tatham & Bro., Philadelphia, Pa.
Simplex Electrical Co., Boston, Mass.
Chicago Insulated Wire Co., Sycamore, Ill.
Crescent Insulated Wire and Cable Co., Trenton, N. J.
Indiana Rubber and Insulated Wire Co., Marion, Ind.
Moore, Alfred F., Philadelphia, Pa.
National India Rubber Co., Bristol, R. I.
New York Insulated Wire Co., New York
Norwich Insulated Wire Co., New York
Splitdorf, C. F., New York
Standard Underground Cable Co., Pittsburgh, Pa.
Western Electric Co., Chicago, Ill.
Bridgeport Brass Co., Bridgeport, Conn.
Campbell Electrical Supply Co., Boston, Mass.
Collyer Insulated Wire Co., Pawtucket, R. I.

Yarn, Thread, Etc.

Samson Cordage Works, Boston, Mass.
Camden Thread Co., Philadelphia, Pa.
Hadley Co., Boston, Mass.
Warren Thread Works, W., Westfield, Mass.
Malcolm Mills Co., Philadelphia, Pa.

Zincs.

Jones & Son, J., New York
Law Battery Co., New York
Ostrander & Co., W. R., New York
Lamarche's Sons, H., New York
d'Infreville, Geo., New York
Edes Mfg. Co., Plymouth, Mass.
Gaylord & Co., F. L., Ansonia, Conn.
Western Electric Co., Chicago, Ill.
Manhattan Electrical Supply Co., New York
Carr Metal Co., Fall River, Mass.

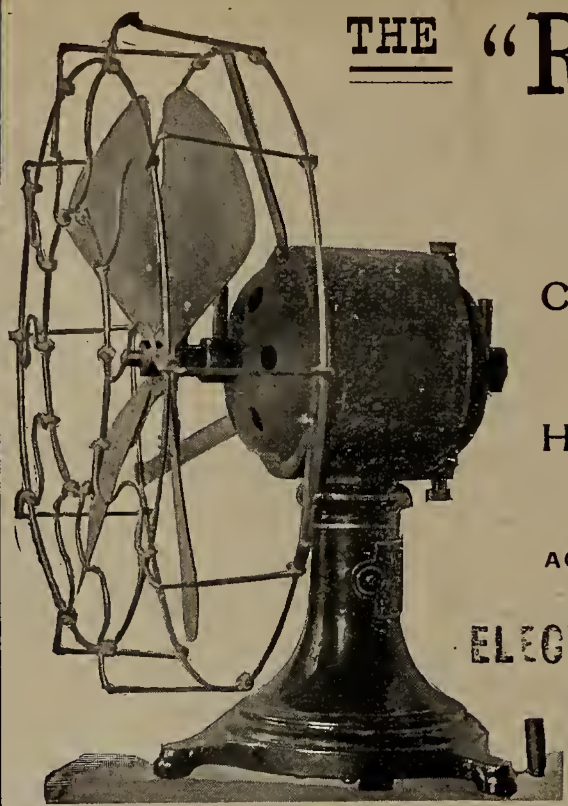
W. A. ROSENBAUM,

Electrical Expert and Patent Solicitor,

177 TIMES BUILDING, N.Y. CITY.

Former Manager, now successor to the Patent Business heretofore conducted by "The Electrical World."

Recommended by The Electrical Age.



THE "RIKER" FAN.

Compact,
Light,
Noiseless,
Handsome,
Good.

AGENTS WANTED.

RIKER ELECTRIC MOTOR CO.

45-47 York Street,

BROOKLYN, N. Y.

JOHN G. KLUMPP & SON,
13 BAXTER ST., N. Y.
TURNERS IN FOREIGN AND DOMESTIC WOODS
Spools, Push-Buttons, Receivers, Etc.
ELECTRIC WORK A SPECIALTY.

PHŒNIX

PHŒNIX RUBBER INSULATING PAINT. COPYRIGHTED

Rubber Insulating Paint

WATER, ACID, AND PRACTICALLY FIRE PROOF.

Manufactured Exclusively By

MORRIS & MacCURDY

Indianapolis, Indiana.

AGENTS.

Devere Electric Co., 180 Plum St., Cincinnati, O.; Standard R'y Supply Co., 1115 Monadnock Blk., Chicago; Partrick Carter Co., Philadelphia; John O. Dolph, 126 Liberty St., New York; Western Electrical Supply Co., St. Louis, Mo.; Cuyahoga Electrical Supply Co., Cleveland, Ohio, and Bergtheil & Young, London, Eng.; Fred. Steinkamp, Dayton, O.

THE

THIRD EDITION JUST OUT.

ENLARGED,
REVISED,
UP-TO-DATE.

"Standard Wiring"

FOR

ELECTRIC LIGHT AND POWER.

Adopted by the Fire Underwriters of the United States.

By H. C. CUSHING, Jr.,
Electrical Inspector Boston Board of Fire Underwriters.

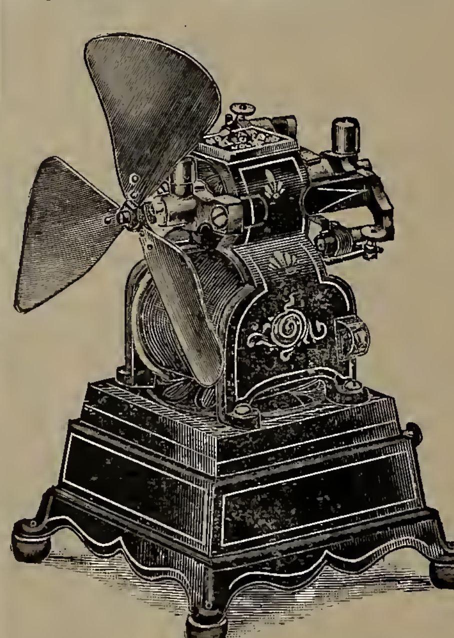
It contains every table, formula and rule for all systems of outside and inside wiring, together with twenty-five illustrations of the newest and safest methods for the installation of Pole Lines, Dynamos, Motors, Switchboards, Transformers, etc., etc., as required by the insurance inspector.

RUSSIAN LEATHER COVER, POCKET SIZE, $1.00

Sent Postpaid to Any Address upon Receipt of Price, by

The Electrical Age Publishing Co., First Floor, World Bldg. NEW YORK.

NORTH AMERICAN ELECTRIC CO.,



FAN MOTORS.

DIRECT CURRENT,

FOR 5 to 14 INCH FANS.

Finest and most efficient small motors.

Prices low, including rheostat.

Battery motors will be ready shortly.

Write for Prices and Description.

North American Motor Co.
181 WILLIAM STREET,
NEW YORK.

NOW READY.

FOURTH EDITION.

Prof. SILVANUS P. THOMPSON'S BOOK,

DYNAMO ELECTRIC MACHINERY.

1,000 pages, 39 plates and many illustrations

Demy 8vo., Cloth. Price $9.00.

Send in your Orders at once.

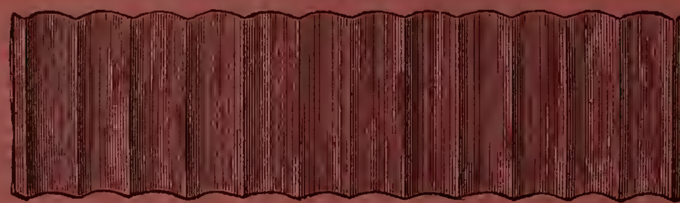
Copies of the above Book sent to any address, postpaid, on receipt of the price. Address:

THE ELECTRICAL AGE PUBLISHING CO.,
World Building, New York.

The Boudreaux Dynamo Brush

IS THE LATEST IMPROVEMENT IN ELECTRICITY.

EACH LAYER OF THIS ANTI-FRICTION METAL



1-1250 PART OF 1 INCH THICK.

NO SPARKING.
NO OVERHEATING.

NO CUTTING.
NO SPREADING.

NO WOVEN WIRE.
NO COPPER.

NO GAUZE.
NO CARBON.

NEW FOLIATED METAL BRUSH.

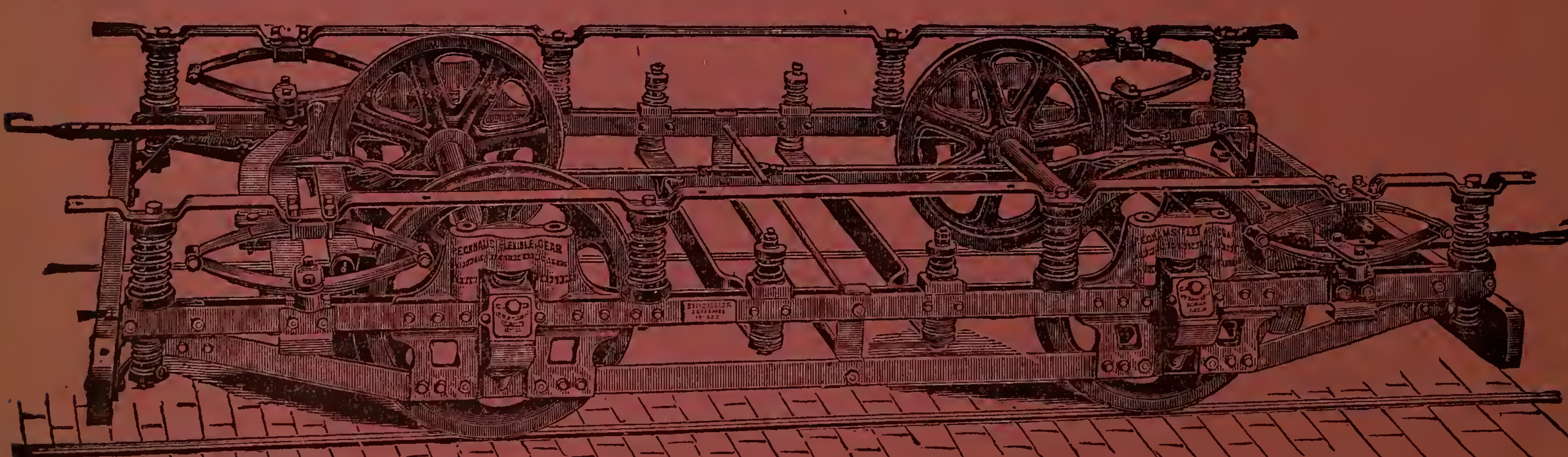
POSTAL TELEGRAPH BLDG., —NEW YORK.— THE BOUDREAUX DYNAMO BRUSH COMPANY, MALLER'S BUILDING, —CHICAGO.—

PECKHAM'S STANDARD

"ELLIPTIC SPRING"

Cantilever Extension Truck

The strongest, easiest riding and longest spring base truck in use. Awarded the highest medal at the World's Fair for superiority of construction.



Constructed with hot rivets; all parts machine fitted and guaranteed. Adopted as standard by all the large Electric Railways in Brooklyn, New York and Jersey City. Cost of Maintenance guaranteed to be less than any other truck. For price list, descriptive catalogue and blue prints, apply to

THE PECKHAM MOTOR TRUCK AND WHEEL CO.,

General Sales Office, Havemeyer Bldg., New York.

NEW YORK.—1320 Havemeyer Bldg., 26 Cortlandt Street.
BOSTON.—Exchange Building, 53 State Street,
CHICAGO.—1137-1138 Monadnock Block.
PHILADELPHIA—420 Walnut Street.
SAN FRANCISCO.—128 California Street.
LONDON.—39 Westminster, S. W.

QUICK POINTERS

HARRISBURG IDEAL ENGINES.
HARRISBURG STEAM ROAD-ROLLERS.
WEITMEYER BOILER SETTING.
Write for information.

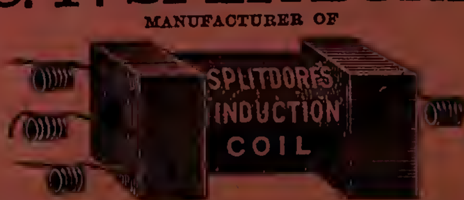
HARRISBURG FOUNDRY AND MACHINE WORKS, U. S. A. HARRISBURG, PA.

FANS

UNDELL CEILING, IN GOOD CONDITION. $15.00 EACH.
J. JONES & SON,
67 CORTLANDT STREET, NEW YORK CITY

WM. MARSHALL,
MANUFACTURER OF
Electric Condensers.
STANDARDS A SPECIALTY.
709 Lexington Ave., NEW YORK.

C. F. SPLITDORF,
MANUFACTURER OF



ELECTRO-MAGNETS and TELEPHONE BOBBINS
17-27 Vandewater St., New York.